[redacted] [redacted]

(2)

CLASSIFICATION CHANGE

To UNCLASSIFIED
By authority of GDS-Ex 11652 Date 12/31/72
Changed by L. Shirley
Classified Document Master Control Station, NASA
Scientific and Technical Information Facility

SID-62-1074

Copy #3

DATA REPORT FOR LANGLEY UNITARY PLAN WIND TUNNEL TESTS (PROJECT 374) OF APOLLO MODEL (FD-2) NAS 9-150

U 4.5.5.1

24 August 1962

Approved by

D. J. Gildea

D. J. Gildea - Manager
Flight Technology

This document contains informati[redacted] national defense of the United States within the meani[redacted] Title 18 U. S. C. Section 793 and 794. Its transmission or [redacted] manner to a[redacted] person is prohibited by [redacted]

[redacted]

NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION

FOREWORD

The tests described herein were conducted under NASA Apollo contract NAS 9-150, during the period from May 29 to June 4, 1962.

This report was prepared by C. L. Berthold & G. B. Henrich of the Wind Tunnel Projects Group, Los Angeles Division of North American Aviation, Inc.

[redacted]

ABSTRACT

This report presents dynamic stability data from tests of command module entry and launch escape configurations of a 0.055-scale Apollo model (FD-2) in the low Mach number test section of the Langley Unitary Plan Wind Tunnel. Tests were conducted from 1.60 to 2.75 Mach number and at angles of attack near proposed flight attitudes.

The dynamic stability parameters are presented as standard NASA coefficients in both tabular and plotted form for all configurations tested. In addition, tunnel operating conditions, configuration description, computation equations, tabulated data identification key, and typical schlieren photographs are included.

This report presents basic wind tunnel test data only, in order to make the test results available at the earliest possible date. Analyses and summary of results will be reported later under separate cover.

[redacted]

TABLE OF CONTENTS

		Page
I.	INTRODUCTION	1
II.	REMARKS	2
III.	MODEL DESCRIPTION	
	A. General and Model Drawings	4
	B. Nomenclature and Dimensions	8
IV.	TEST PROCEDURE	
	A. Test Nomenclature	10
	B. Model Installation	13
	C. Instrumentation	14
	D. Data Reduction Constants	14
V.	REFERENCES	15
	APPENDIX "A"	
	A. Tabulated Data Format	A-2
	B. Run Index	A-4
	C. Tabulated Data	A-5~A-32
	APPENDIX "B"	
	A. Index of Figures	B-2
	B. Model Photographs	B-4
	C. Plotted Data	B-8
	D. Schlieren Photographs	B-24~B-27

[redacted]

I. INTRODUCTION

Dynamic stability tests were conducted on 0.055-scale Apollo (FD-2) models in the low speed test section of the Langley Unitary Plan Wind Tunnel from May 29 to June 4, 1962. Dynamic stability parameters were obtained for the command module entry and launch escape configurations with oscillation in pitch and for the command module entry configuration only, with oscillation in yaw.

Tests were conducted at Mach numbers of 1.60, 1.80, 2.00, 2.50, and 2.75 to fill in the Mach number range not covered in two previous tests on this model (Ref. a & b). A more current Launch Escape configuration was tested with and without a disc near the rocket base. The basic configurations were run at two stagnation pressures to obtain the effect of Reynolds number variation. Reynolds numbers, based on the maximum diameter of the model, varied from 0.628×10^6 to 3.98×10^6. All dynamic stability derivatives were measured during forced oscillation of the model in pitch or yaw over an amplitude of approximately $\pm 2^\circ$ about the oscillation center.

[redacted]

[redacted]

II. REMARKS

This test was performed to investigate the dynamic stability characteristics of the 0.055-scale Apollo (FD-2) models in the Mach number range 1.60 - 2.75, using models, equipment, and methods of obtaining data similar to that described for two previous tests (Ref. a & b), which covered the Mach number range of 2.40 - 4.65 and 0.30 - 1.20, respectively.

Several techniques are currently available for measuring dynamic stability derivatives of models in wind tunnels. This test was performed utilizing what has been termed the inexorable method in which the model is mechanically forced to oscillate in a single degree of freedom at known angular frequency and amplitude while measurements are made of the moment required to sustain the motion.

The support and attached model were forced to perform a constant-amplitude, essentially sinusoidal motion about the oscillation axis by a mechanical scotch yoke and crank arrangement. The crank was connected by a driveshaft to an electric motor mounted in the downstream end of the sting and the drive motor speed was set at various constant values to provide a range of oscillating frequencies. (For maximum accuracy, most test points were recorded at or near the natural frequency of the oscillating model system).

Springs of different stiffness were available to cover a range of resonant frequencies within the range of operating frequencies. These springs were equipped with calibrated strain gages to provide a signal proportional to the displacement.

A stiff strain gage beam, located between the model mounting point and the pivot axis, gave a signal proportional to the moment applied to oscillate the model. It was located so as to be uninfluenced by any friction or mechanical play in the system.

The model was rigidly forced to oscillate with an amplitude of approximately $\pm 2^{\circ}$ at known angular frequency and the pivot axis could be rotated 90°, therefore, tests could be made with the model oscillating in pitch or yaw.

By resolving the moment and amplitude functions into orthogonal components the resultant applied moment and displacement and the phase angle between them may be found. With the known oscillation frequency, the aerodynamic-damping and oscillatory-stability moments can be computed.

[redacted]

II. REMARKS - continued

The tabular and plotted data are presented in Appendices A and B in NASA standard coefficient form referred to the body system of axes originating at the oscillation center. Dynamic stability parameters are utilized to indicate aerodynamic damping-in-pitch ($C_{m_q} + C_{m_{\dot{\alpha}}}$), oscillatory longitudinal stability ($C_{m_\alpha} - k^2 C_{m_{\dot{q}}}$), and the reduced frequency parameter $\frac{\omega \ell}{V}$ for tests with oscillations in pitch for the entry, launch escape (3 config.), and command module exit configurations. In addition, coefficients are given for aero-dynamic damping-in-yaw ($C_{n_r} - C_{n_{\dot{\beta}}} \cos \alpha$), oscillatory directional stability ($C_{n_\beta} \cos \alpha + k^2 C_{n_{\dot{r}}}$) and the reduced frequency parameter $\frac{\omega \ell}{V}$ for the entry configuration only with oscillations in yaw. The plotted data presents these parameters as a function of angle of attack.

Configurations were tested at Mach numbers ranging from 1.60 to 2.75 and at angles of attack near the proposed flight attitudes. The nominal angle of attack ranges were: Command Module (entry) 134° to 158°; Command Module (exit) - 16° to +8°; Launch Escape Configuration -16° to +8°. The majority of data were recorded at nominal 2° increments of set angle of attack throughout these ranges while the model was being rigidly forced to oscillate ±2° in pitch about the set angle. Smaller increments of set angle of attack were used in areas where large changes in stability parameters were observed.

The current Launch Escape Vehicle was tested throughout the standard Mach No. range at two Reynolds Nos. with two configurations; i.e., E_{35} T_{15} C_2- Rocket Disc Off and E_{40} T_{15} C_2 - Rocket Disc On. For comparative purposes with previous tests (Ref. a & b), the configuration E_4 T_{12} C_2 (Long Tower) was tested at M = 1.80 & 2.00 at the maximum Reynolds No.

The command module in entry attitude was run using two different oscillation centers to determine the magnitude of error introduced by such movement. This configuration was also run at two Mach numbers with oscillation in yaw, but the bulk of the test was conducted with oscillation in pitch only.

Any data believed to be affected by shock reflections from the tunnel walls have been deleted from the tabulated sheets and plotted figures. However, because of a malfunction in the angle-of-attack read-out mechanism, the tabulated values of angle of attack for runs 10 through 26 are higher than the nominal angle by as much as 0.17°. For runs 27 and 28, the tabulated angles of attack are low by an equal amount.

[redacted]

[redacted]

III. MODEL DESCRIPTION

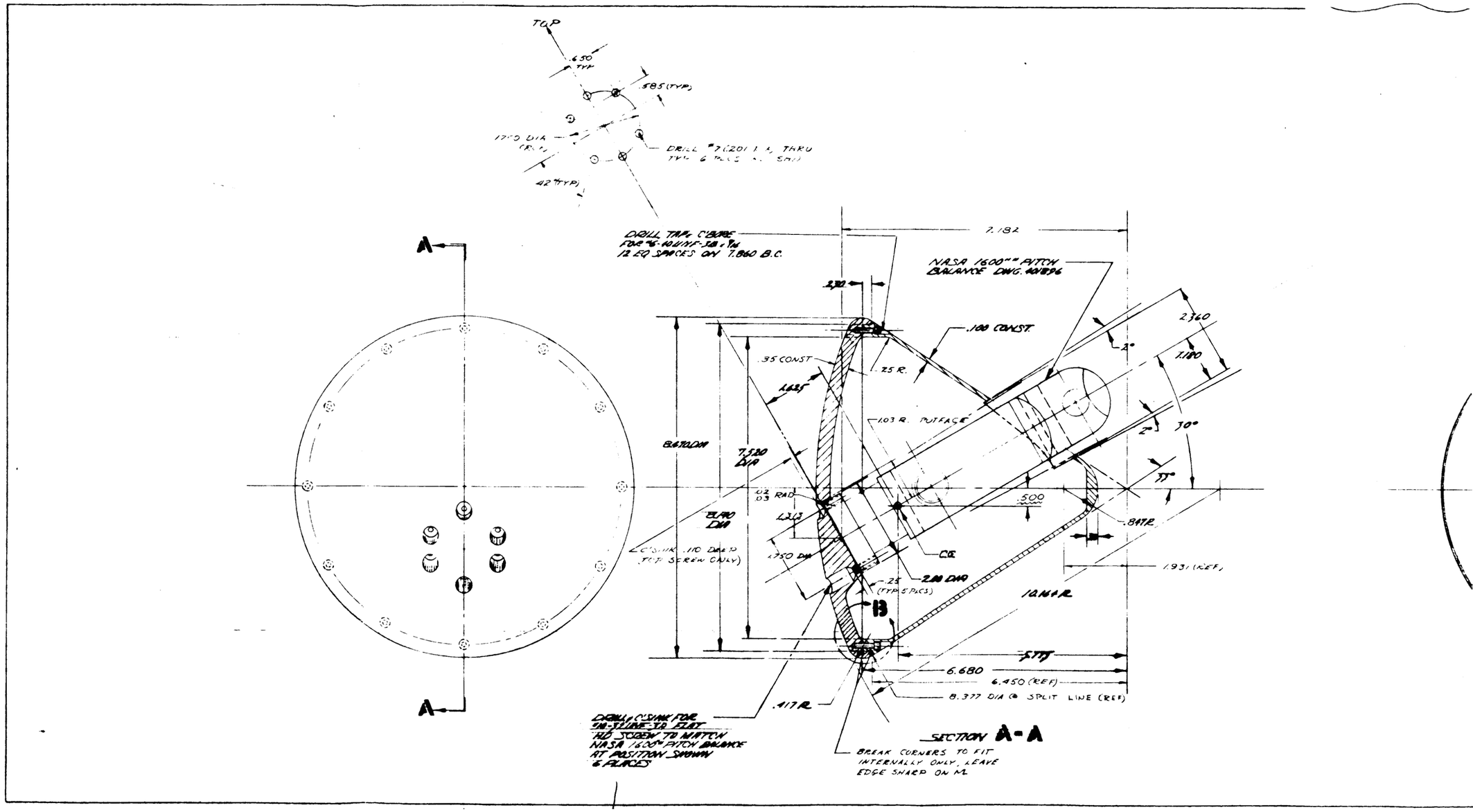
A. General

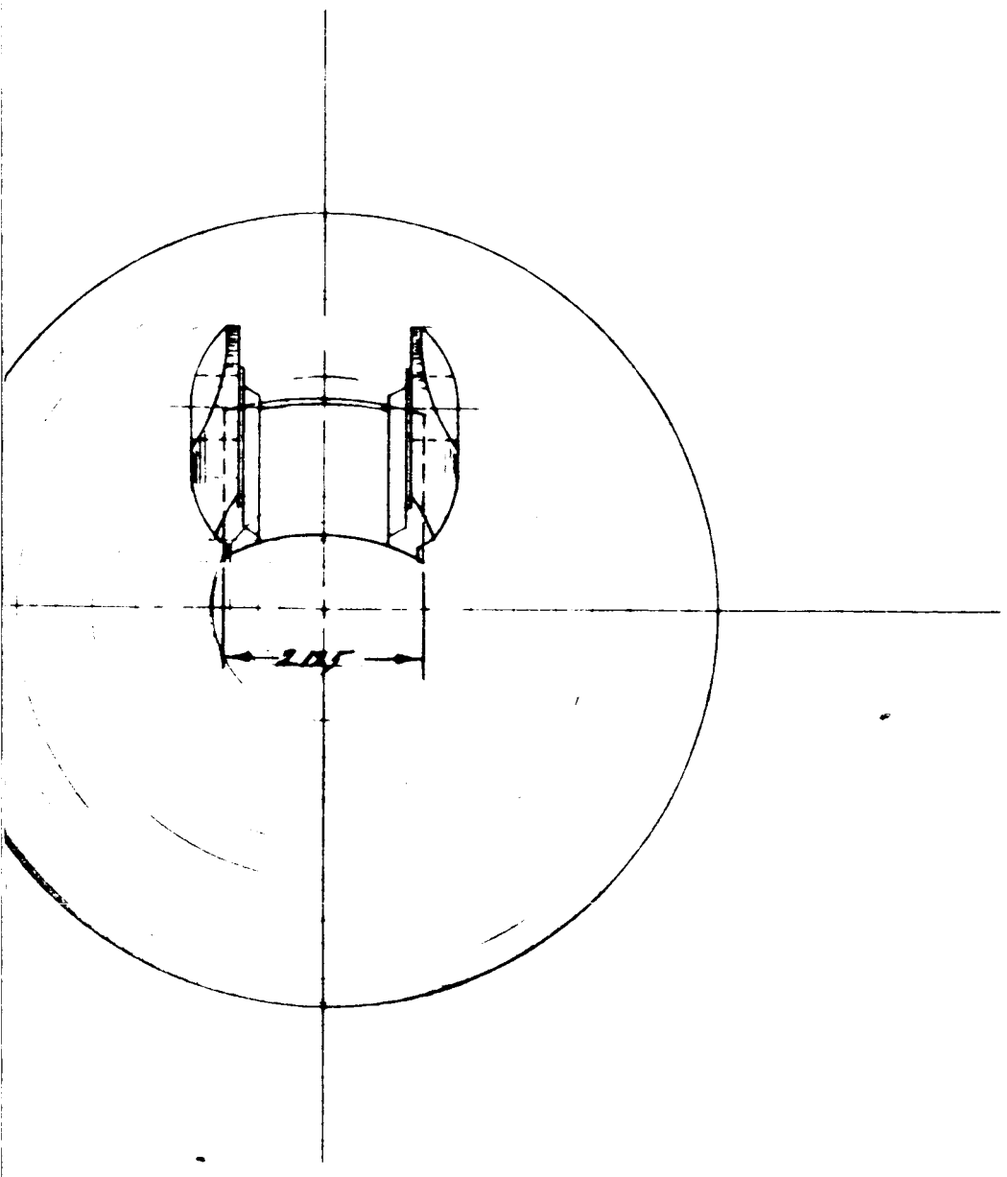
The FD-2 Dynamic Stability Model tested in the low speed test section of the Unitary Plan Wind Tunnel from May 29 to June 4, 1962, was a 0.055-scale representation of the Apollo command module and launch escape vehicle configurations. In addition to the launch escape models used in the two previous programs, a more current launch escape configuration was constructed for these tests.

The configurations tested were aerodynamically smooth for all test conditions. Lightweight materials were utilized in construction of the model, to reduce moment-of-inertia effects, whenever consistent with the structural integrity as established in Reference (c). The command modules were constructed of aluminum alloy (7075-T6), escape tower of Armco steel (17-4 PH SST) and escape rocket of magnesium (QQ-M-31).

The oscillation axis was located as close as possible to the center of gravity of the full scale Apollo vehicle within the physical limits imposed by the model size, chosen to avoid reflected shock waves, and the balance dimensions.

The models were sting mounted with the balance contained within the model to minimize support interference. To allow pitching through angles of attack near the proposed flight attitudes, the models were constructed so that the module axis of symmetry and balance center line formed an angle of 30° for the entry configuration and 8° for the launch escape system.


TOP
.650 TYP
.585 (TYP)
.42 (TYP)
DRILL TAP & C'BORE FOR #6-40 UNF-3B x 9/16 12 EQ SPACES ON 7.860 B.C.
7.182
NASA 1600"" PITCH BALANCE DWG. 401896
.100 CONST.
.35 CONST
.25 R.
1.625
1.03 R. PUTFACE
2.360
7.180
2°
30°
33°
8.670 DIA
7.520 DIA
.02 .03 RAD
8.190 DIA
1.313
.500
.847 R
C'SINK .110 DEEP (TOP SCREW ONLY)
1.750 DIA
CE
2.00 DIA
.25 (TYP 5 PLCS)
1.931 (REF)
10.164 R
B
6.680
6.450 (REF)
8.377 DIA @ SPLIT LINE (REF)
.417 R
DRILL & C'SINK FOR #10-32 UNF-3B FLAT HD SCREW TO MATCH NASA 1600"" PITCH BALANCE AT POSITION SHOWN 6 PLACES
BREAK CORNERS TO FIT INTERNALLY ONLY, LEAVE EDGE SHARP ON M
SECTION A-A
A
A



2. MATL 7075-T6 ALUM
1. MAJOR FACTOR = .005
NOTES UNLESS OTHERWISE SPECIFIED

REL Nº 2
DATE 2-13-62
JOB Nº 242-518

REL 2 REVISED BASE ATTACHMENT FADDED DIMEN

REQD	REQD	PART NO.	DESC	MATERIAL	SIZE	ZONE	MAT. SPEC	ASSY REQUIRED ON	NEXT ASSY APPLICATION
				LIST OF MATERIAL					

DRILLED HOLE TOLERANCES	
.040	TO .1285 +.002, -.001
.136	TO .2285 +.002, -.001
.204	TO 1/5 +.004, -.001
28/64	TO 9/44 +.005, -.001
49/64	TO 1.1 +.007, -.001
1-1/64	TO 5 +.010, -.001

TOLERANCE EXCEPT AS NOTED
ANGLES ±1/2°
DECIMALS .XX = ±.03 .XXX = ±.010
✓ SURFACE ROUGHNESS PER MIL-STD-10
HEAT TREAT
FINISH

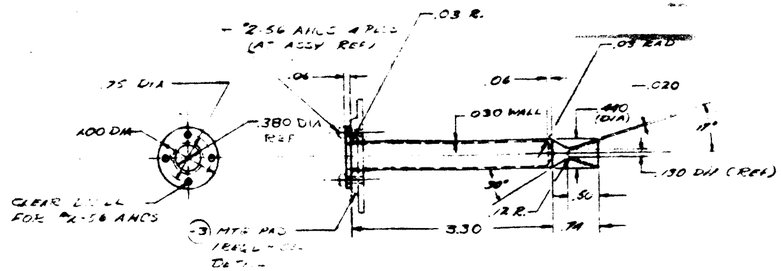
DATE
DR BY EXTURE
CHK BY
APPD BY
APPD BY

MODEL RSSY-[illegible]
FD-2 RE-ENTRY CONFIG
(LANGLEY UPWT)

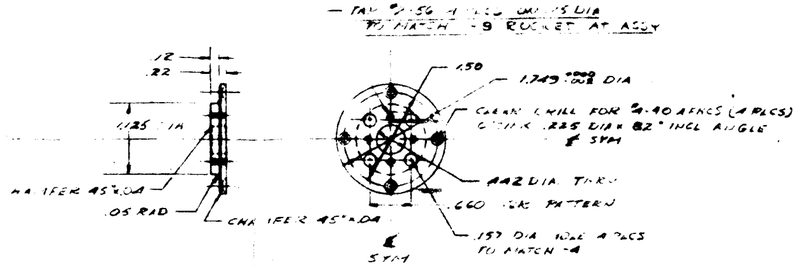
SCALE FULL WT

NORTH AMERICAN AVIATION, INC.
[illegible]

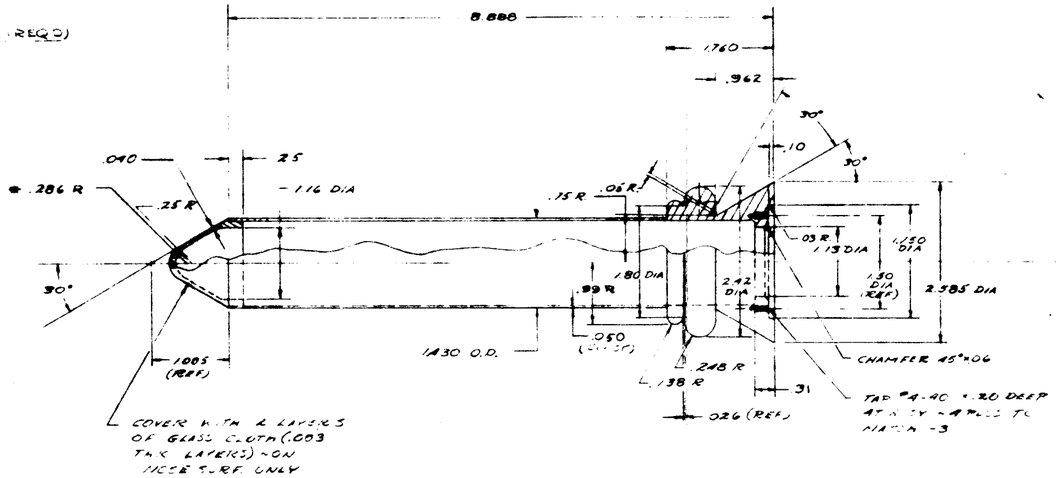
SIZE B 7121-01059



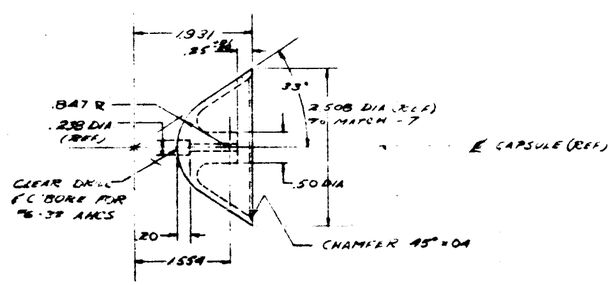
-9 DETAIL ~ JETISON ROCKET (1 REQD)
MATL ~ 7075-T6 AL ALY
SCALE ~ ACTUAL SIZE



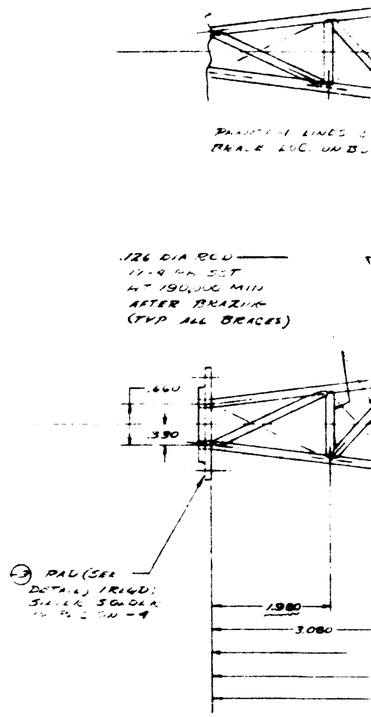
-3 DETAIL ~ ESCAPE ROCKET MTG PAD (1 REQD REF)
MATL ~ 17-4 PH SST HT 190000 MIN
SCALE ~ ACTUAL SIZE



-5 DETAIL ~ ESCAPE ROCKET ASSY (1 REQD REF)
MATL : MAGNESIUM QQ M-31 AZ61 M-F
SCALE : ACTUAL SIZE



-8 DETAIL ~ CAPSULE NOSE (1 REQD REF)
MATL ~ 7075-T6 AL ALY
SCALE ~ ACTUAL SIZE

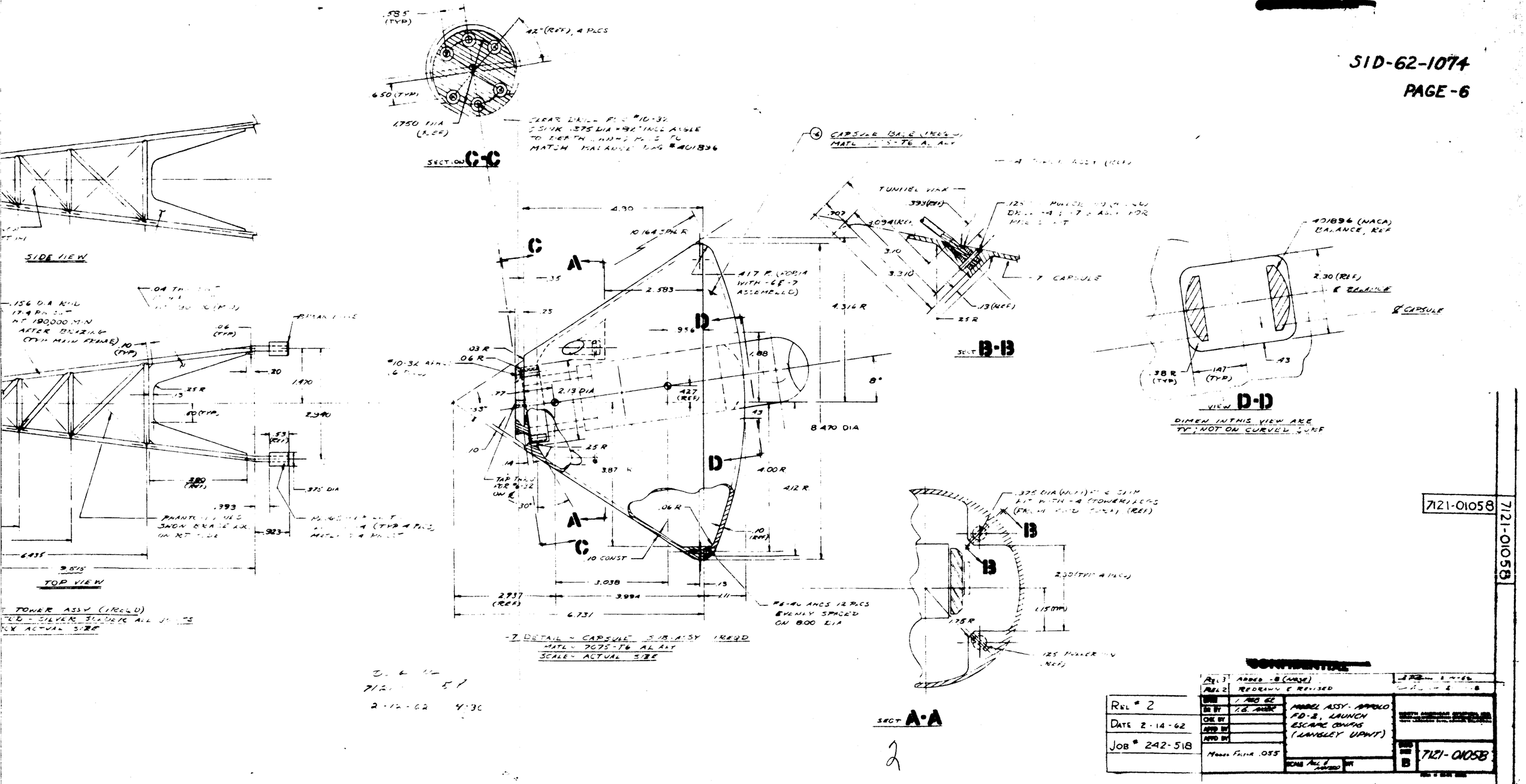


-4 DETAIL ~ ESCAPE
MATL ~ AS NOTED
SCALE ~ APPL

[redacted]

SID-62-1074

PAGE-6



7121-01058

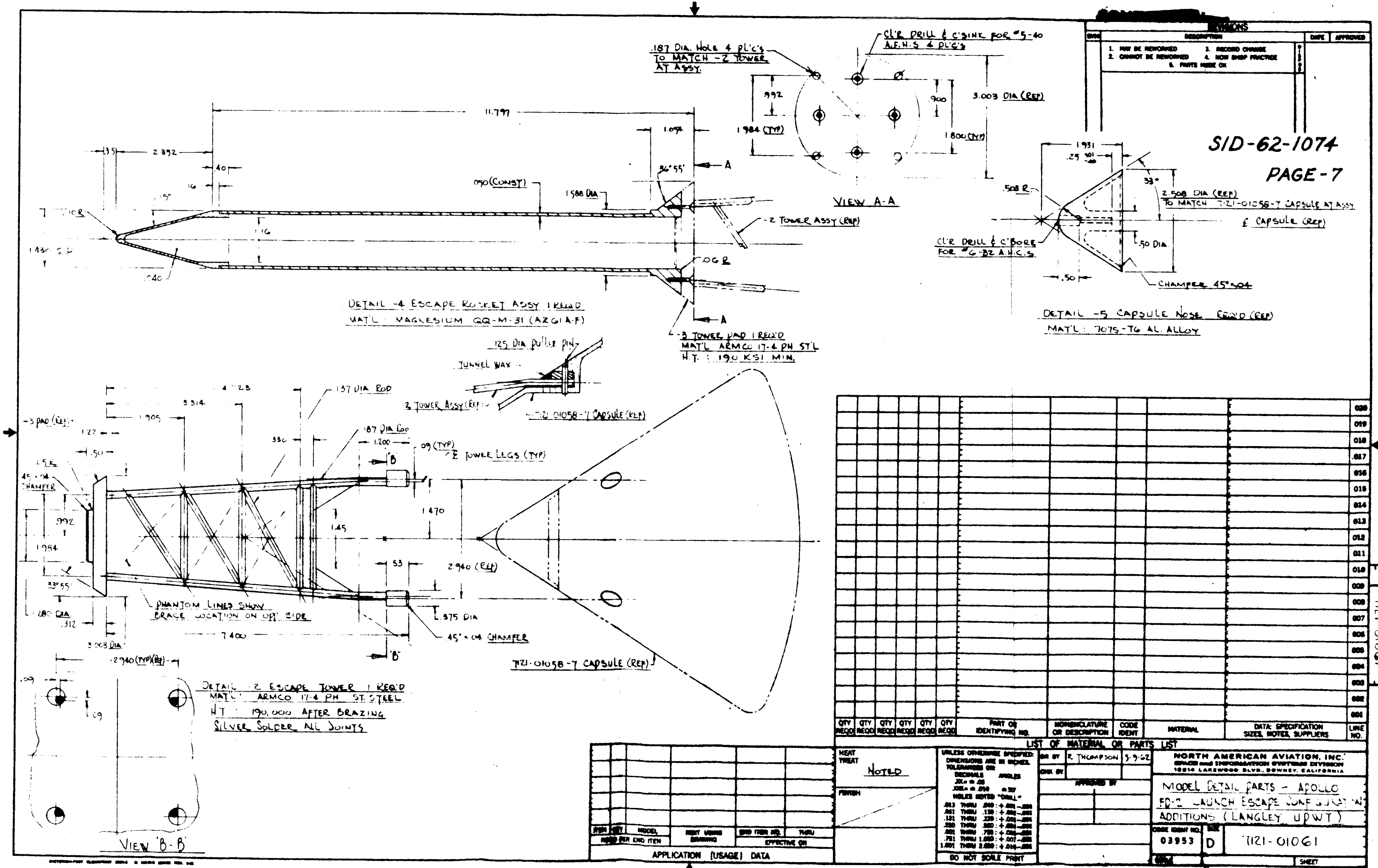
7121-01058

[redacted]

REL # 2	REL 3	ADDED -8 (NOSE)	
DATE 2-14-62	REL 2	REDRAWN & REVISED	
JOB # 242-518	DRN	1 FEB 62	MODEL ASSY - APPOLO FD-2, LAUNCH ESCAPE CONFIG (LANGLEY UPWT)
	DR BY	I.G. AMER	
	CHK BY		
	APPD BY		
	APPD BY		
	MODEL FACTOR .055		SCALE ALL & NOTED

DWG SIZE B 7121-01058

2



REVISIONS
SYM
DESCRIPTION
DATE
APPROVED
1. MAY BE REWORKED
2. CANNOT BE REWORKED
3. RECORD CHANGE
4. NOW SHOP PRACTICE
5. PARTS MADE OK
SID-62-1074
PAGE-7
.187 DIA. HOLE 4 PL'C'S TO MATCH -2 TOWER AT ASSY.
CL'R DRILL & C'SINK FOR #5-40 A.F.H.S 4 PL'C'S
3.003 DIA (REF)
1.984 (TYP)
1.800 (TYP)
VIEW A-A
11.797
2.352
.40
.050 (CONST)
1.588 DIA
36°55'
-2 TOWER ASSY (REF)
.06 R
DETAIL -4 ESCAPE ROCKET ASSY 1 REQ'D
MAT'L MAGNESIUM QQ-M-31 (AZ61A-F)
-3 TOWER PAD 1 REQ'D
MAT'L ARMCO 17-4 PH ST'L
H.T. 190 KSI MIN.
1.931
.25
33°
2.508 DIA (REF) TO MATCH 7121-01058-7 CAPSULE AT ASSY
℄ CAPSULE (REF)
.508 R
CL'R DRILL & C'BORE FOR #6-32 A.H.C.S
.50 DIA
CHAMFER 45°×.04
DETAIL -5 CAPSULE NOSE REQ'D (REF)
MAT'L: 7075-T6 AL. ALLOY
.125 DIA PULLER PIN
TUNNEL WAX
-2 TOWER ASSY (REF)
7121-01058-7 CAPSULE (REF)
.137 DIA ROD
.187 DIA ROD
-3 PAD (REF)
.09 (TYP)
℄ TOWER LEGS (TYP)
45°×.04 CHAMFER
1.470
2.940 (REF)
PHANTOM LINES SHOW BRACE LOCATION ON OPP. SIDE
.375 DIA
45°×.04 CHAMFER
7.400
3.003 DIA
2.940 (TYP)(REF)
7121-01058-7 CAPSULE (REF)
DETAIL -2 ESCAPE TOWER 1 REQ'D
MAT'L ARMCO 17-4 PH ST. STEEL
H.T. 190,000 AFTER BRAZING
SILVER SOLDER ALL JOINTS
VIEW 'B-B'
QTY REQD
PART OR IDENTIFYING NO.
NOMENCLATURE OR DESCRIPTION
CODE IDENT
MATERIAL
DATA: SPECIFICATION SIZES, NOTES, SUPPLIERS
LINE NO.
LIST OF MATERIAL OR PARTS LIST
ITEM
MODEL
NEXT USING DRAWING
END ITEM NO.
THRU
REQD PER END ITEM
EFFECTIVE ON
APPLICATION (USAGE) DATA
HEAT TREAT
NOTED
FINISH
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES. TOLERANCES ON: DECIMALS .XX= ±.03 .XXX= ±.010 ANGLES ±30' HOLES NOTED "DRILL"
DO NOT SCALE PRINT
DR BY R. THOMPSON 5-9-62
CHK BY
APPROVED BY
NORTH AMERICAN AVIATION, INC.
SPACE and INFORMATION SYSTEMS DIVISION
12214 LAKEWOOD BLVD., DOWNEY, CALIFORNIA
MODEL DETAIL PARTS - APOLLO
FD-2 LAUNCH ESCAPE CONFIGURATION
ADDITIONS (LANGLEY UPWT)
CODE IDENT NO. 03953
SIZE D
7121-01061
SHEET
7121-01061

[redacted]

III. MODEL DESCRIPTION - continued

B. Nomenclature

	Dimensions Full Scale
E_4, Escape Rocket Motor (Dwg. 7121-01058-5)	
Total length (including jettison motor)	248.40 in.
Diameter of Escape Rocket	26.00 in.
Diameter of Escape Rocket Base	47.00 in.
Skirt Flare Angle	30.00°
Nose Cone Half-angle	30.00°
Nose Radius	5.20 in.
Jettison Motor - located aft of rocket motor	
Length of Jettison Motor	69.50 in.
Diameter of Jettison Motor	8.00 in.
Jettison Motor-nozzle exit half angle	17.00°
E_{40}, Escape Rocket Motor (Dwg. 7121-01061-4)	
Total length	257.28 in.
Diameter of Escape Rocket	26.00 in.
Diameter of Escape Rocket Base	54.60 in.
Skirt Angle Flare	36.92°
Nose Cone Half-angle	15.00°
Nose Radius	2.00 in.
Disc - located forward of skirt flare	
Diameter of Disc	65.00 in.
Disc Thickness	2.27 in.
E_{35}, Same as "E " except no disc near base of rocket	
T_{12}, Escape Tower Structure (Dwg. 7121-01058-4)	
Total length	175.00 in.
Number of Longitudinal Members	4
Diameter of Longitudinal Members	2.84 in.
Diameter of Cross Braces	2.29 in.
Distance between attachment points	53.45 in.

[redacted]

[redacted]

III. MODEL DESCRIPTION - continued

		Dimensions Full Scale
T_{15},	Escape Tower Structure (Dwg. 7121-01061-2)	
	Total length	116.10 in.
	Number of Longitudinal Members	4
	Diameter of Longitudinal Members	3.40 in.
	Diameter of Cross Braces	2.49 in.
	Distance between attachment points	50.18 in.
C,	Command Module (Dwg. 7121-01059)	
	Maximum Diameter	154.00 in.
	Radius of Spherical Blunt End	184.80 in.
	Corner Radius	7.58 in.
	Nose Cone Half-angle	33.00°
	Nose Cone Vertex Radius	15.40 in.
C_2,	Command Module (Dwg. 7121-01061-5)	
	Maximum Diameter	154.00 in.
	Radius of Spherical Blunt End	184.80 in
	Corner Radius	7.58 in.
	Nose Cone Semi-angel	33.00°
	Nose Cone Vertex Radius	9.15 in.

[redacted]

[redacted]

IV. TEST PROCEDURE

A. Test Nomenclature

A maximum cross-sectional area, sq. ft., $\frac{\pi \ell^2}{4}$

ℓ maximum body diameter, ft.

q_∞ free stream dynamic pressure, lb/sq. ft.

α angle of attack of model center line, deg. or radians

$\dot{\alpha}$ rate of change of angle of attack, radians/sec.

V free stream velocity, ft/sec.

ω angular frequency of oscillation, radians/sec.

k reduced frequency parameter, $\frac{\omega \ell}{V}$

R Reynolds number base on ℓ

q angular velocity in pitch, radians/sec.

$\dot{q}$ rate of change of pitching angular velocity, radians/sec.

r angular velocity in yaw, radians/sec.

$\dot{r}$ rate of change of yawing angular velocity, radians/se.

β angle of sideslip of model center line, radians

$\dot{\beta}$ rate of change of angle of sideslip, radians/sec.

C_m pitching-moment coefficient, $\frac{\text{Pitching Moment}}{q_\infty \ A \ \ell}$

C_n yawing-moment, coefficient, $\frac{\text{Yawing Moment}}{q_\infty \ A \ \ell}$

I moment of inertia, slug-ft^2

[redacted]

[redacted]

IV. TEST PROCEDURE - continued

A. Test Nomenclature - continued

The data presented are referred to the body system of axes and all moments are referred to the intersection of the oscillation axes. Additional coefficients and symbols used in the equations for data reduction are defined as follows:

C —— system damping moment, in-lb/radian

K —— system spring constant, in-lb/radian

$C_{aero} = C_{run} - C_{tare}$ where C_{tare} = constant

$(K-I\omega^2)_{aero} = (K-I\omega^2)_{run} - (K-I\omega^2)_{tare}$

For data of type 2 (oscillation in pitch, wingless bodies)

$$C_{m_q} + C_{m_{\dot{\alpha}}} = - \frac{VC_{aero}}{12\, q_\infty\, A\ell^2}$$

$\ell = 0.7058$ ft.

$$C_{m_\alpha} - k^2 C_{m_{\dot{q}}} = - \frac{(K-I\omega^2)_{aero}}{12\, q_\infty\, A\ell}$$

$A = 0.3912$ ft.^{2}

$$k = \frac{\omega \ell}{V}$$

For data of type 4 (oscillation in yaw, wingless bodies)

$$C_{n_r} - C_{n_{\dot{\beta}}} \cos\alpha = - \frac{VC_{aero}}{12 q_\infty\, A\ell^2}$$

$$C_{n_\beta} \cos\alpha + k^2 C_{n_{\dot{r}}} = + \frac{(K-I\omega^2)_{aero}}{12 q_\infty\, A\ell}$$

$$k = \frac{\omega \ell}{V}$$

[redacted]

[redacted]

IV. TEST PROCEDURE - continued

A. Test Nomenclature - continued

$q = 0.7\, p\, M^2$

$p = \dfrac{\text{Stagnation pressure}}{(1 + .2M^2)^{3.5}}$

$V = \dfrac{(49.0236 \sqrt{T_t}\,)\, M}{(1 + .2M^2)^{1/2}}$ (where T_t is tunnel total temperature in $^{\circ}R$)

Reynolds number $= 2 \ell q_\infty / \mu V$ (where μ = viscosity, $\frac{\text{lb-sec.}}{\text{ft}^2}$)

[redacted]

IV. TEST PROCEDURE - continued

B. Model Installation

The FD-2 model was installed on the NASA 1600 in-lb. dynamic pitch balance (Dwg. 401896) which was mounted on a straight sting containing the oscillating mechanish. The drive motor, clutch resolvers, and frequency generator were all contained in the downstream end of the sting which was stiffened to provide a resonant frequency above the maximum oscillating frequency of the model. The oscillating mechanism was designed to provide maximum stiffness of all drive linkages so that the model responded only to the essentially sinusoidal forcing input of the crank and Scotch yoke.

The models were mounted so that the sting center line and command module axis of symmetry formed an angle of 30° for the entry configuration and 8° for the launch escape configuration to allow testing through angles of attack of 134° to 158° and -16 to +8° respectively. The Unitary tunnels basic sting-type support system, which is mounted on a horizontal support strut extending from wall to wall, allowed the model to be traversed across the tunnel to minimize interference from reflected shock waves on the model at higher angles of attack.

[redacted]

IV. TEST PROCEDURE - continued

C. Instrumentation

The NASA 1600 in.-lb. dynamic pitch balance was used to measure the moment and displacement functions as the model was mechanically forced to oscillate in a single degree of freedom.

In operation of the system, calibrated outputs of the moment and displacement strain gages are passed through coupled electrical sine-cosine resolvers which rotate at the frequency of oscillation. The resolvers transformed the outputs into orthogonal components from which the resultant applied moment and displacement and the phase angle between them were found. With the known oscillation frequency, the aerodynamic-damping and oscillating stability moments were then computed.

All data were computed on a remotely located IBM 7090 computer.

D. Data Reduction Constants

All data was reduced and presented in standard NASA coefficient form referred to the body system of axes originating at the oscillation center.

Reference area = A = 0.3912 ft.^{2}

Reference length = ℓ = 0.7058 ft. (Diam.)

[redacted]

[redacted]

V. REFERENCES

(a) SID-62-536, "Data Report for Longley Unitary Plan Wind Tunnel Tests (Project 349) of Apollo Model (FD-2) NAS 9-150 (U)" by C. L. Berthold, 28 May, 1962.

(b) SID-62-1065, "Data Report for Langley 8 Ft. TPT Wind Tunnel Tests (Project 233) of Apollo Model (FD-2) NAS 9-150 (U)" by C. L. Berthold, 20 August, 1962.

(c) SID-62-103, "Structural Analysis of the .055-scale Apollo Wind Tunnel Models", 16 February 1962.

(d) NACA RM L58A28 "Dynamic Directional Stability Derivatives for a 45° Swept-Wing-Vertical-Tail Airplane Model at Transonic Speeds and Angles of Attack, with a Description of the Mechanism and Instrumentation Employed" by Albert L. Braslow, Harleth G. Wiley and Cullen Q. Lee, April 21, 1958.

(e) NASA TM X-39 "Dynamic-Longitudinal and Directional Stability Derivatives for a 45° Sweptback-Wing Airplane Model at Transonic Speeds" by Ralph P. Bielat and Harleth G. Wiley, August 1959.

(f) NASA TM X-285 "Wind Tunnel Investigation at Low Subsonic Speeds of the Static and Oscillatory Stability Characteristics of Models of Several Space Capsule Configurations" by Joseph L. Johnson, Jr., May 1960.

[redacted]

APPENDIX "A"

[redacted]

A. TABULATED DATA FORMAT

Column. Heading	Item	Definition or Remarks
PRJ	Project No.	From project no. 374 of LUPWT.
RUN	Run No.	Each Mach number considered separate run.
POINT	Point No.	Sequence in which data were taken.
CONF	Configuration No.	10. "C", Command Module, (re-entry). NAA Dwg. 7121-01059, no spacer 11. as above but with 1.75" spacer 20. "E_{35} T_{15} C_2", Launch Escape. NAA Dwg. 7121-01061 21. as above but with "E_{40}" disk on rocket 22. "E_4 T_{12} C_2", Launch Escape, toroidal tanks removed. NAA Dwg. 7121-01058 with capsule nose replaced by nose given in Detail-5 of NAA Dwg. 7121-01061 30. "C_2", Command Module, (exit)
T	Type of Data	2. Wingless body in pitch 4. Wingless body in yaw
B	Batch No.	This number designates a group of data which requires a given set of constants and tares in order to compute.
Q	Dynamic Pressure	Free-stream dynamic pressure lb/ft^2
V	Velocity	Free-stream velocity ft/sec
RN	Reynolds No.	Reynolds No. x 10^{-6} based on a a reference length of 0.7058 ft. (This is the maximum diameter of the command module model)

[redacted]

[redacted]

A. TABULATED DATA FORMAT - continued

Column. Heading	Item	Definition or Remarks
TP	--	Corrected phase angle between driving torque and model displacement. Values near 90° and 270° indicate velocity resonance.
MACH	Mach No.	Free-stream Mach number
AOS	Angle of Sideslip	Mean angle of sideslip, degrees.
AOA	Angle of Attack	Angle of attack of the model, degrees.
FREQ	Frequency	Frequency of the forced oscillation cycles/sec.
K	Reduced Frequency Parameter	k, see equations
CMQ	$C_{m_q} + C_{m_{\dot{\alpha}}}$	Damping-in-pitch parameter
CMA	$C_{m_\alpha} = k^2 C_{m_{\dot{q}}}$	Oscillatory longitudinal stability parameter
CNR	$C_{n_r} = C_{n_{\dot{\beta}}} \cos \alpha$	Damping-in-yaw parameter
CNB	$C_{n_\beta} \cos \alpha + K^2 C_{n_{\dot{r}}}$	Oscillatory directional stability parameter

Note: See Test Nomenclature for definition of stability parameters.

[redacted]

B. RUN INDEX

RUN NO.	CONFIGURATION	REMARKS	MACH NO.	ANGLE RANGE	RNX10^{-6}	q PSF
1	Command Module	Fwd. Osc.	1.60	158° to 148°	2.44	787
2	C-Entry	Center	1.80	158° to 134°	2.28	737
3	↓	↓	2.50	158° to 134°	2.56	787
4			2.50	142° to 134°	.72	221
5			2.00	158° to 134°	2.48	789
6			2.00	158° to 134°	.97	309
7			1.80	158° to 134°	1.06	341
27*			1.80	158° to 134°	2.28	737
28*			2.00	158° to 134°	2.48	787
8		Osc.Cen.Aft.	1.80	158° to 147°	2.29	737
9		1.75" Spacer	2.00	158° to 149°	2.49	789
10	Launch Escape	E_{40} T_{15} C_2	2.75	-16° to +8°	.63	182
11	(116" Tower)	(Disc On)	2.75	- 8° to +6°	2.77	801
12	(257"Rocket)	↓	2.50	- 8° to +7°	2.91	897
13	↓		1.80	-10° to +8°	1.06	342
14			1.80	- 8° to +7°	3.67	1184
15			2.00	- 7° to +6°	3.99	1264
16		E_{35} T_{15} C_2	1.80	- 7° to +6°	3.67	1184
17		(Disc Off)	2.00	- 8° to +7°	3.95	1253
18		↓	2.50	- 7° to +7°	2.91	897
19			2.75	- 8° to +8°	2.77	801
20			2.75	0 to +8°	.63	182
21			1.80	- 9° to +8°	1.06	340
22	↓	↓	2.75	-16° to +4°	.63	181
23	Launch Escape	$E_4T_{12}C_2$	1.80	- 7° to +6°	3.67	1185
24	(175" Tower)	↓	2.00	- 7° to +6°	3.95	1254
25	Command Module	Osc.Cen.-c.g.	1.80	-16° to +8°	3.67	1186
26	C_2-Exit	1.21" Spacer	2.00	-16° to +8°	3.95	1254

NOTE:
1. * - Oscillations in Yaw
2. Runs 1 - 26, Oscillation in Pitch
3. Reynolds numbers based on maximum model diameter.
4. All values quoted are nominal

[redacted]

NASA
Langley Research Center
Langley Station
Hampton, Virginia

JUN 18 1962

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	001	0032	10	2	01	786.46	1542.8	2.444	105.69	1.600	.00	149.98	14.50	.0416	.06-	.086-
374	001	0033	10	2	01	786.42	1542.8	2.444	94.62	1.600	.00	157.98	14.46	.0415	.01-	.086-
374	001	0034	10	2	01	786.75	1542.8	2.445	90.37	1.600	.00	155.96	14.51	.0417	.01	.087-
374	001	0035	10	2	01	786.75	1542.8	2.445	97.98	1.600	.00	153.96	14.82	.0425	.02-	.098-
374	001	0036	10	2	01	786.92	1542.8	2.446	92.22	1.600	.00	152.98	14.56	.0418	.11-	.089-
374	001	0037	10	2	01	787.30	1542.8	2.447	91.64	1.600	.00	151.97	14.59	.0419	.18-	.090-
374	001	0038	10	2	01	787.09	1542.8	2.446	93.55	1.600	.00	150.98	14.54	.0417	.04-	.088-
374	001	0040	10	2	01	787.55	1542.8	2.448	99.12	1.600	.00	149.95	14.48	.0416	.01-	.086-
374	001	0042	10	2	01	787.60	1542.8	2.448	135.47	1.600	.00	148.98	14.37	.0413	.04	.082-
374	001	0043	10	2	01	787.60	1542.8	2.448	117.03	1.600	.00	147.98	14.40	.0413	.03	.083-

[redacted]

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

JUN 18 1962

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	002	0046	10	2	01	736.51	1662.5	2.283	95.33	1.800	.00	157.98	14.42	.0384	.01-	.090-
374	002	0047	10	2	01	736.51	1662.5	2.283	94.44	1.800	.00	155.96	14.41	.0384	.03-	.089-
374	002	0048	10	2	01	736.75	1662.5	2.284	94.96	1.800	.00	153.94	14.46	.0385	.02-	.091-
374	002	0049	10	2	01	736.59	1662.5	2.284	109.02	1.800	.00	152.96	14.45	.0385	.03	.091-
374	002	0050	10	2	01	736.79	1662.5	2.284	90.49	1.800	.00	151.97	14.35	.0382	.02-	.087-
374	002	0051	10	2	01	736.79	1662.5	2.284	90.56	1.800	.00	150.98	14.39	.0383	.00	.089-
374	002	0052	10	2	01	736.86	1662.5	2.285	90.68	1.800	.00	149.95	13.15	.0350	.22-	.043-
374	002	0053	10	2	01	736.90	1662.5	2.285	90.68	1.800	.00	150.48	13.28	.0354	.21-	.048-
374	002	0054	10	2	01	736.67	1662.5	2.284	92.19	1.800	.00	150.98	13.40	.0357	.19-	.052-
374	002	0055	10	2	01	736.51	1662.5	2.283	93.13	1.800	.00	148.98	12.77	.0340	.27-	.029-
374	002	0056	10	2	01	736.55	1662.5	2.284	90.80	1.800	.00	147.98	12.53	.0334	.30-	.022-
374	002	0057	10	2	01	736.51	1662.5	2.283	91.66	1.800	.00	145.98	11.87	.0316	.43-	.000-
374	002	0058	10	2	01	736.55	1662.5	2.284	91.85	1.800	.00	143.94	11.52	.0307	.35-	.010
374	002	0059	10	2	01	736.75	1662.5	2.284	90.92	1.800	.00	141.93	11.38	.0303	.22-	.014
374	002	0060	10	2	01	736.63	1662.5	2.284	92.76	1.800	.00	139.97	10.97	.0292	.19-	.027
374	002	0061	10	2	01	736.55	1662.5	2.284	90.97	1.800	.00	137.93	10.50	.0280	.21-	.040
374	002	0062	10	2	01	736.67	1662.5	2.284	89.05	1.800	.00	136.00	9.89	.0263	.20-	.056
374	002	0068	10	2	01	736.67	1662.5	2.284	95.33	1.800	.00	134.04	9.33	.0248	.19-	.071

CONFIDENTIAL

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	003	0072	10	2	01	787.50	2017.9	2.562	90.62	2.500	.00	157.98	14.36	.0315	.05-	.082-
374	003	0073	10	2	01	788.19	2017.9	2.564	90.62	2.500	.00	155.96	14.00	.0307	.10-	.069-
374	003	0074	10	2	01	787.07	2017.9	2.560	96.15	2.500	.00	153.96	13.67	.0300	.16-	.057-
374	003	0075	10	2	01	786.66	2017.9	2.559	88.88	2.500	.00	152.98	13.49	.0296	.18-	.052-
374	003	0076	10	2	01	786.84	2017.9	2.560	90.61	2.500	.00	151.97	13.36	.0293	.19-	.047-
374	003	0077	10	2	01	786.61	2017.9	2.559	97.03	2.500	.00	150.98	13.24	.0290	.14-	.043-
374	003	0078	10	2	01	786.84	2017.9	2.560	94.85	2.500	.00	149.97	13.08	.0287	.14-	.038-
374	003	0079	10	2	01	787.63	2017.9	2.562	93.10	2.500	.00	148.98	12.94	.0284	.11-	.033-
374	003	0080	10	2	01	787.22	2017.9	2.561	98.28	2.500	.00	147.98	12.66	.0278	.17-	.024-
374	003	0081	10	2	01	786.38	2017.9	2.558	92.53	2.500	.00	146.96	12.42	.0272	.19-	.017-
374	003	0082	10	2	01	785.53	2017.9	2.555	92.41	2.500	.00	145.98	12.19	.0267	.21-	.010-
374	003	0083	10	2	01	785.76	2017.9	2.556	93.03	2.500	.00	143.94	12.05	.0264	.14-	.005-
374	003	0084	10	2	01	785.74	2017.9	2.556	90.73	2.500	.00	141.93	11.75	.0258	.15-	.002
374	003	0085	10	2	01	786.33	2017.9	2.558	90.79	2.500	.00	139.97	11.27	.0247	.15-	.016
374	003	0086	10	2	01	786.17	2017.9	2.557	88.35	2.500	.00	137.95	10.74	.0236	.15-	.031
374	003	0087	10	2	01	786.38	2017.9	2.558	95.89	2.500	.00	136.00	10.31	.0226	.15-	.043
374	003	0088	10	2	01	785.94	2017.9	2.557	96.42	2.500	.00	134.04	9.72	.0213	.15-	.057

CONFIDENTIAL
PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	004	0092	10	2	01	220.79	2017.9	.718	99.18	2.500	.00	134.04	11.45	.0251	.09-	.042
374	004	0093	10	2	01	221.51	2017.9	.720	105.10	2.500	.00	136.00	11.52	.0253	.01-	.035
374	004	0094	10	2	01	220.51	2017.9	.717	114.21	2.500	.00	137.93	11.69	.0256	.02	.018
374	004	0095	10	2	01	220.69	2017.9	.718	106.95	2.500	.00	139.97	11.80	.0259	.02	.006
374	004	0096	10	2	01	220.85	2017.9	.718	99.12	2.500	.00	141.93	11.94	.0262	.02	.009-
374	004	0097	10	2	01	220.74	2017.9	.718	105.04	2.500	.00	143.94	12.07	.0265	.00-	.022-
374	004	0099	10	2	01	220.82	2017.9	.718	90.98	2.500	.00	144.98	12.09	.0265	.00-	.026-

[redacted]

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

18 1962

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	005	0102	10	2	01	788.59	1767.5	2.486	117.10	2.000	.00	158.37	14.68	.0368	.03	.093-
374	005	0103	10	2	01	788.77	1767.5	2.486	90.56	2.000	.00	155.96	14.47	.0363	.05-	.086-
374	005	0104	10	2	01	788.85	1767.5	2.487	99.54	2.000	.00	153.94	14.12	.0354	.06-	.073-
374	005	0105	10	2	01	788.70	1767.5	2.486	98.06	2.000	.00	152.96	13.78	.0345	.08-	.061-
374	005	0106	10	2	01	788.99	1767.5	2.487	94.56	2.000	.00	151.97	13.33	.0334	.13-	.046-
374	005	0107	10	2	01	789.10	1767.5	2.487	92.27	2.000	.00	150.98	13.14	.0329	.18-	.040-
374	005	0109	10	2	01	788.92	1767.5	2.487	93.54	2.000	.00	149.97	12.92	.0324	.21-	.032-
374	005	0110	10	2	01	789.53	1767.5	2.489	93.92	2.000	.00	148.96	12.74	.0319	.19-	.026-
374	005	0111	10	2	01	788.88	1767.5	2.487	92.24	2.000	.00	147.98	12.51	.0313	.21-	.019-
374	005	0113	10	2	01	789.17	1767.5	2.488	94.24	2.000	.00	146.96	12.15	.0304	.29-	.008-
374	005	0114	10	2	01	788.67	1767.5	2.486	93.17	2.000	.00	145.96	11.92	.0299	.29-	.001-
374	005	0115	10	2	01	788.13	1767.5	2.484	95.81	2.000	.00	144.96	11.81	.0296	.27-	.002
374	005	0116	10	2	01	788.20	1767.5	2.485	95.43	2.000	.00	143.94	11.75	.0294	.22-	.003
374	005	0117	10	2	01	788.31	1767.5	2.485	95.19	2.000	.00	141.91	11.49	.0288	.14-	.010
374	005	0118	10	2	01	787.84	1767.5	2.483	98.23	2.000	.00	139.97	11.08	.0277	.12-	.022
374	005	0119	10	2	01	788.45	1767.5	2.485	95.43	2.000	.00	137.95	10.64	.0266	.14-	.034
374	005	0120	10	2	01	788.20	1767.5	2.485	96.82	2.000	.00	136.18	10.06	.0252	.19-	.049
374	005	0121	10	2	01	788.34	1767.5	2.485	95.87	2.000	.00	134.03	9.37	.0235	.27-	.066

CONFIDENTIAL
PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

JUN 18 1962

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	006	0125	10	2	01	309.54	1767.5	.975	90.74	2.000	.00	157.98	13.20	.0331	.02	.108-
374	006	0126	10	2	01	309.79	1767.5	.976	87.22	2.000	.00	155.96	13.06	.0327	.12-	.096-
374	006	0127	10	2	01	309.29	1767.5	.975	90.80	2.000	.00	153.96	12.93	.0324	.14-	.085-
374	006	0128	10	2	01	308.86	1767.5	.973	88.81	2.000	.00	151.97	12.52	.0314	.35-	.052-
374	006	0129	10	2	01	308.75	1767.5	.973	90.86	2.000	.00	150.98	12.43	.0311	.33-	.045-
374	006	0130	10	2	01	308.75	1767.5	.973	93.25	2.000	.00	149.97	12.43	.0311	.28-	.044-
374	006	0131	10	2	01	308.71	1767.5	.973	85.65	2.000	.00	148.98	12.33	.0309	.25-	.038-
374	006	0132	10	2	01	308.71	1767.5	.973	88.36	2.000	.00	147.98	12.21	.0306	.27-	.028-
374	006	0133	10	2	01	308.68	1767.5	.973	93.24	2.000	.00	146.98	12.08	.0303	.29-	.017-
374	006	0134	10	2	01	308.75	1767.5	.973	90.85	2.000	.00	145.98	11.99	.0300	.28-	.010-
374	006	0135	10	2	01	308.71	1767.5	.973	88.31	2.000	.00	144.96	11.96	.0300	.26-	.009-
374	006	0136	10	2	01	308.71	1767.5	.973	88.12	2.000	.00	143.96	11.96	.0300	.24-	.009-
374	006	0137	10	2	01	308.75	1767.5	.973	94.22	2.000	.00	141.91	11.88	.0298	.17-	.002-
374	006	0138	10	2	01	308.75	1767.5	.973	84.19	2.000	.00	139.97	11.69	.0293	.17-	.010
374	006	0139	10	2	01	308.68	1767.5	.973	94.50	2.000	.00	137.93	11.52	.0289	.16-	.024
374	006	0140	10	2	01	308.71	1767.5	.973	90.91	2.000	.00	135.98	11.32	.0284	.16-	.038
374	006	0141	10	2	01	308.68	1767.5	.973	94.62	2.000	.00	134.04	11.11	.0278	.17-	.054

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

1962

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	007	0144	10	2	01	340.36	1662.5	1.055	93.86	1.800	.00	134.04	10.91	.0291	.20-	.062
374	007	0145	10	2	01	340.44	1662.5	1.055	90.78	1.800	.00	136.00	11.14	.0297	.13-	.046
374	007	0146	10	2	01	340.44	1662.5	1.055	94.61	1.800	.00	137.93	11.40	.0304	.12-	.030
374	007	0147	10	2	01	340.48	1662.5	1.055	83.18	1.800	.00	139.97	11.58	.0308	.12-	.016
374	007	0148	10	2	01	340.68	1662.5	1.056	93.74	1.800	.00	141.93	11.76	.0313	.18-	.006
374	007	0149	10	2	01	340.80	1662.5	1.056	92.58	1.800	.00	143.94	11.78	.0314	.37-	.005
374	007	0150	10	2	01	340.64	1662.5	1.056	85.89	1.800	.00	144.96	11.77	.0313	.45-	.003
374	007	0151	10	2	01	340.72	1662.5	1.056	90.66	1.800	.00	145.98	11.87	.0316	.46-	.001-
374	007	0152	10	2	01	340.88	1662.5	1.057	92.30	1.800	.00	146.98	12.03	.0320	.42-	.012-
374	007	0153	10	2	01	340.96	1662.5	1.057	88.81	1.800	.00	147.98	12.18	.0324	.36-	.023-
374	007	0154	10	2	01	341.04	1662.5	1.057	86.97	1.800	.00	148.98	12.29	.0327	.35-	.031-
374	007	0155	10	2	01	341.04	1662.5	1.057	93.06	1.800	.00	149.97	12.55	.0334	.23-	.049-
374	007	0156	10	2	01	341.04	1662.5	1.057	93.62	1.800	.00	150.98	12.77	.0340	.15-	.065-
374	007	0157	10	2	01	341.04	1662.5	1.057	87.03	1.800	.00	151.97	13.00	.0346	.10-	.083-
374	007	0158	10	2	01	340.80	1662.5	1.056	86.58	1.800	.00	153.96	13.19	.0351	.07-	.097-
374	007	0159	10	2	01	340.76	1662.5	1.056	95.45	1.800	.00	155.96	13.18	.0351	.04-	.096-
374	007	0160	10	2	01	340.68	1662.5	1.056	81.91	1.800	.00	157.98	13.21	.0352	.06-	.099-

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

JUN 18 1962

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	008	0022	11	2	02	737.54	1662.5	2.287	92.61	1.800	.00	146.96	3.54	.0094	3.25-	.146
374	008	0023	11	2	02	737.65	1662.5	2.287	95.23	1.800	.00	146.96	3.52	.0093	3.25-	.148
374	008	0024	11	2	02	737.02	1662.5	2.285	234.73	1.800	.00	147.98	4.67	.0124	.23	.119
374	008	0025	11	2	02	737.10	1662.5	2.285	91.94	1.800	.00	148.98	4.28	.0114	.56-	.128
374	008	0026	11	2	02	737.10	1662.5	2.285	134.97	1.800	.00	149.95	5.10	.0136	.17-	.108
374	008	0027	11	2	02	737.22	1662.5	2.286	92.02	1.800	.00	150.98	5.20	.0138	.43-	.102
374	008	0028	11	2	02	737.22	1662.5	2.286	108.43	1.800	.00	151.97	5.84	.0155	.13-	.082
374	008	0029	11	2	02	737.06	1662.5	2.285	153.27	1.800	.00	153.96	7.00	.0186	.02	.039
374	008	0030	11	2	02	737.10	1662.5	2.285	266.45	1.800	.00	155.96	8.06	.0214	.68	.007-
374	008	0031	11	2	02	737.50	1662.5	2.286	270.40	1.800	.00	157.98	7.83	.0208	1.36	.001
374	008	0032	11	2	02	737.06	1662.5	2.285	269.95	1.800	.00	156.69	7.92	.0211	2.50	.002-
374	008	0033	11	2	02	736.98	1662.5	2.285	269.56	1.800	.00	155.07	7.71	.0205	.48	.007
374	008	0034	11	2	02	737.06	1662.5	2.285	112.56	1.800	.00	153.00	6.28	.0167	.28-	.068

CONFIDENTIAL
PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	009	0037	11	2	02	788.42	1767.5	2.485	117.10	2.000	.00	157.96	7.65	.0191	.00	.010
374	009	0038	11	2	02	788.59	1767.5	2.486	93.37	2.000	.00	155.96	6.96	.0174	.19-	.037
374	009	0039	11	2	02	788.92	1767.5	2.487	90.67	2.000	.00	153.96	6.14	.0154	.23-	.066
374	009	0040	11	2	02	789.06	1767.5	2.487	87.35	2.000	.00	151.97	5.24	.0131	.51-	.094
374	009	0041	11	2	02	789.20	1767.5	2.488	90.78	2.000	.00	150.98	4.69	.0117	.50-	.109
374	009	0042	11	2	02	789.20	1767.5	2.488	92.46	2.000	.00	149.95	4.27	.0107	.61-	.120
374	009	0043	11	2	02	789.24	1767.5	2.488	96.05	2.000	.00	148.98	3.02	.0075	.90-	.145
374	009	0044	11	2	02	788.52	1767.5	2.486	91.99	2.000	.00	149.49	3.73	.0093	1.17-	.132

[redacted]

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	010	0014	21	2	03	182.28	2100.6	.631	140.45	2.750	.00	8.04	4.52	.0095	.82-	.287
374	010	0015	21	2	03	181.88	2100.6	.630	140.36	2.750	.00	6.10	4.90	.0103	.73-	.203
374	010	0016	21	2	03	181.95	2100.6	.630	140.32	2.750	.00	4.15	5.73	.0120	.55-	.004-
374	010	0017	21	2	03	182.18	2100.6	.631	44.66	2.750	.00	3.15	6.20	.0130	.27-	.161-
374	010	0018	21	2	03	182.22	2100.6	.631	184.47	2.750	.00	2.12	7.15	.0150	.57	.425-
374	010	0019	21	2	03	182.24	2100.6	.631	228.31	2.750	.00	1.13	8.11	.0171	1.74	.775-
374	010	0020	21	2	03	182.30	2100.6	.631	290.11	2.750	.00	.15	8.49	.0179	2.62	.957-
374	010	0022	21	2	03	181.86	2100.6	.629	259.69	2.750	.00	359.17	8.31	.0175	2.25	.868-
374	010	0023	21	2	03	182.16	2100.6	.630	265.62	2.750	.00	358.16	7.55	.0159	1.20	.587-
374	010	0024	21	2	03	182.39	2100.6	.631	151.83	2.750	.00	357.15	6.67	.0140	.11	.284-
374	010	0025	21	2	03	182.47	2100.6	.632	65.45	2.750	.00	356.12	6.03	.0127	.36-	.107-
374	010	0026	21	2	03	182.43	2100.6	.631	105.03	2.750	.00	354.12	5.16	.0108	1.27-	.131
374	010	0027	21	2	03	181.93	2100.6	.630	82.77	2.750	.00	352.14	4.77	.0100	1.61-	.215
374	010	0028	21	2	03	182.37	2100.6	.631	81.92	2.750	.00	350.11	4.96	.0104	1.35-	.171
374	010	0029	21	2	03	182.41	2100.6	.631	94.85	2.750	.00	348.12	5.06	.0106	.78-	.151
374	010	0030	21	2	03	181.99	2100.6	.630	130.00	2.750	.00	346.10	4.89	.0103	.90-	.202
374	010	0031	21	2	03	181.99	2100.6	.630	81.76	2.750	.00	344.12	4.66	.0098	.79-	.240
374	010	0032	21	2	03	182.26	2100.6	.631	110.54	2.750	.00	347.08	4.98	.0105	1.06-	.175
374	010	0033	21	2	03	182.20	2100.6	.631	87.00	2.750	.00	348.12	5.05	.0106	.96-	.152
374	010	0034	21	2	03	182.30	2100.6	.631	84.56	2.750	.00	352.12	4.76	.0100	1.32-	.218
374	010	0035	21	2	03	182.43	2100.6	.631	115.21	2.750	.00	353.10	4.88	.0103	1.18-	.200

PRELIMINARY

[redacted]

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	011	0038	21	2	03	800.87	2100.6	2.774	142.98	2.750	.00	6.10	3.73	.0078	.64-	.104
374	011	0039	21	2	03	800.74	2100.6	2.773	112.29	2.750	.00	4.13	7.57	.0159	.33-	.132-
374	011	0040	21	2	03	800.78	2100.6	2.773	147.97	2.750	.00	3.15	9.00	.0190	.22-	.252-
374	011	0041	21	2	03	800.91	2100.6	2.774	17.07	2.750	.00	2.15	10.00	.0211	.00-	.371-
374	011	0042	21	2	03	801.10	2100.6	2.774	261.46	2.750	.00	1.15	11.63	.0245	.52	.551-
374	011	0043	21	2	03	801.06	2100.6	2.774	269.01	2.750	.00	.17	12.25	.0258	.83	.632-
374	011	0044	21	2	03	801.10	2100.6	2.774	197.85	2.750	.00	359.17	12.21	.0257	.39	.603-
374	011	0045	21	2	03	800.85	2100.6	2.774	206.95	2.750	.00	359.17	12.21	.0257	.63	.600-
374	011	0046	21	2	03	801.86	2100.6	2.777	266.00	2.750	.00	358.14	11.27	.0237	.51	.507-
374	011	0047	21	2	03	801.10	2100.6	2.774	165.76	2.750	.00	357.13	9.95	.0210	.02-	.348-
374	011	0048	21	2	03	801.06	2100.6	2.774	177.03	2.750	.00	356.12	8.66	.0182	.07	.222-
374	011	0049	21	2	03	801.12	2100.6	2.774	50.51	2.750	.00	354.10	5.53	.0116	.52-	.001
374	011	0050	21	2	03	800.41	2100.6	2.772	132.26	2.750	.00	352.14	2.08	.0043	3.04-	.160

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

JUN 18 1962

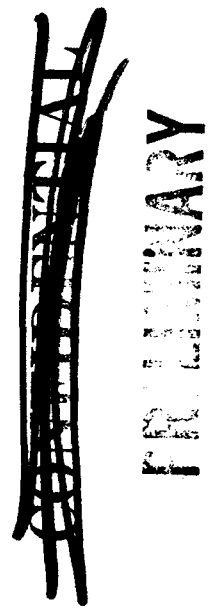
PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	012	0053	21	2	03	895.46	2017.9	2.913	124.06	2.500	.00	.17	12.21	.0268	.59-	.548-
374	012	0054	21	2	03	895.71	2017.9	2.914	106.49	2.500	.00	1.15	11.37	.0249	.49-	.461-
374	012	0055	21	2	03	896.66	2017.9	2.917	91.66	2.500	.00	2.14	10.66	.0234	.49-	.390-
374	012	0056	21	2	03	896.74	2017.9	2.917	70.26	2.500	.00	3.15	9.51	.0208	.22-	.281-
374	012	0057	21	2	03	896.87	2017.9	2.917	37.73	2.500	.00	4.13	8.24	.0181	.14-	.177-
374	012	0058	21	2	03	896.56	2017.9	2.916	77.32	2.500	.00	6.10	4.28	.0094	.76-	.063
374	012	0059	21	2	03	897.07	2017.9	2.918	145.98	2.500	.00	5.11	6.63	.0145	.58-	.042-
374	012	0060	21	2	03	896.43	2017.9	2.916	101.47	2.500	.00	5.11	6.58	.0144	.46-	.052-
374	012	0061	21	2	03	896.28	2017.9	2.916	111.40	2.500	.00	6.10	4.14	.0090	.83-	.074
374	012	0062	21	2	03	896.28	2017.9	2.916	173.72	2.500	.00	7.08	2.03	.0044	1.01-	.178
374	012	0063	21	2	03	896.53	2017.9	2.916	241.11	2.500	.00	359.17	12.18	.0267	.17	.555-
374	012	0064	21	2	03	896.87	2017.9	2.917	79.90	2.500	.00	358.14	11.80	.0259	.22-	.514-
374	012	0065	21	2	03	897.25	2017.9	2.919	134.21	2.500	.00	356.10	9.74	.0214	.09-	.296-
374	012	0066	21	2	03	896.64	2017.9	2.917	112.44	2.500	.00	354.10	6.32	.0138	.44-	.034-
374	012	0067	21	2	03	896.58	2017.9	2.917	184.33	2.500	.00	352.12	1.97	.0043	1.02	.188

CONFIDENTIAL

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	013	0071	21	2	03	341.27	1662.5	1.058	143.89	1.800	.00	.15	8.46	.0225	.03-	.490-
374	013	0072	21	2	03	341.63	1662.5	1.059	185.27	1.800	.00	2.12	7.84	.0209	.20	.365-
374	013	0073	21	2	03	341.94	1662.5	1.060	75.41	1.800	.00	4.15	6.72	.0179	.39-	.167-
374	013	0074	21	2	03	342.54	1662.5	1.062	106.03	1.800	.00	6.08	5.60	.0149	.54-	.011
374	013	0075	21	2	03	342.54	1662.5	1.062	109.51	1.800	.00	8.05	3.96	.0105	.65-	.207
374	013	0076	21	2	03	342.89	1662.5	1.063	251.54	1.800	.00	358.14	8.52	.0227	.92	.502-
374	013	0077	21	2	03	343.09	1662.5	1.063	270.06	1.800	.00	356.12	7.60	.0202	.50	.322-
374	013	0078	21	2	03	343.25	1662.5	1.064	157.54	1.800	.00	354.12	6.48	.0172	.01	.117-
374	013	0079	21	2	03	343.29	1662.5	1.064	87.87	1.800	.00	352.14	4.75	.0126	.67-	.117
374	013	0080	21	2	03	343.40	1662.5	1.064	165.61	1.800	.00	350.11	1.99	.0053	.15-	.357



LIBRARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	014	0085	21	2	03	1184.92	1662.5	3.674	264.66	1.800	.00	.17	15.71	.0419	3.00	.766-
374	014	0086	21	2	03	1184.17	1662.5	3.672	283.79	1.800	.00	2.14	11.42	.0304	.54	.360-
374	014	0087	21	2	03	1184.32	1662.5	3.672	96.40	1.800	.00	4.15	6.84	.0182	.52-	.052-
374	014	0088	21	2	03	1184.32	1662.5	3.672	124.86	1.800	.00	6.08	4.12	.0109	.37-	.057
374	014	0089	21	2	03	1184.72	1662.5	3.673	169.33	1.800	.00	7.06	1.93	.0051	1.07-	.133
374	014	0090	21	2	03	1185.11	1662.5	3.675	269.07	1.800	.00	1.15	14.12	.0376	1.75	.604-
374	014	0091	21	2	03	1185.03	1662.5	3.674	259.16	1.800	.00	358.16	13.57	.0361	1.77	.538-
374	014	0092	21	2	03	1184.52	1662.5	3.673	25.71	1.800	.00	356.12	8.93	.0238	.00-	.175-
374	014	0093	21	2	03	1184.09	1662.5	3.671	151.52	1.800	.00	354.12	6.92	.0184	.14-	.050-
374	014	0094	21	2	03	1183.89	1662.5	3.671	244.13	1.800	.00	352.14	2.14	.0057	1.33	.102
374	014	0095	21	2	03	1184.32	1662.5	3.672	104.24	1.800	.00	355.10	8.01	.0213	.14-	.115-
374	014	0096	21	2	03	1184.13	1662.5	3.671	237.01	1.800	.00	357.15	10.80	.0288	.48	.298-

[redacted]

[redacted]

PRELIMINARY

NASA
Langley Research Center
Langley Station
Hampton, Virginia

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	015	0100	21	2	03	1264.93	1767.5	3.988	263.38	2.000	.00	.15	15.90	.0398	.94	.744-
374	015	0101	21	2	03	1264.61	1767.5	3.987	256.32	2.000	.00	2.14	12.29	.0308	.19	.402-
374	015	0102	21	2	03	1263.86	1767.5	3.984	126.22	2.000	.00	4.15	7.83	.0196	.34-	.093-
374	015	0103	21	2	03	1264.50	1767.5	3.986	143.32	2.000	.00	6.10	3.90	.0097	.51-	.064
374	015	0104	21	2	03	1264.43	1767.5	3.986	254.48	2.000	.00	358.14	14.72	.0369	1.03	.616-
374	015	0105	21	2	03	1264.90	1767.5	3.988	233.39	2.000	.00	356.12	10.12	.0253	.16	.236-
374	015	0106	21	2	03	1265.43	1767.5	3.989	88.03	2.000	.00	354.10	6.51	.0163	.30-	.035-
374	015	0107	21	2	03	1264.40	1767.5	3.986	84.26	2.000	.00	353.14	4.28	.0107	.47-	.045
374	015	0108	21	2	03	1265.08	1767.5	3.988	67.07	2.000	.00	355.10	8.17	.0204	.16-	.119-
374	015	0109	21	2	03	1264.25	1767.5	3.985	273.48	2.000	.00	357.13	12.39	.0310	.65	.413-

PRELIMINARY

CONFIDENTIAL

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	016	0022	20	2	04	1184.48	1662.5	3.673	82.75	1.800	.00	6.10	4.56	.0121	.92-	.042
374	016	0023	20	2	04	1184.88	1662.5	3.674	90.29	1.800	.00	4.15	5.75	.0153	1.27-	.003
374	016	0024	20	2	04	1184.17	1662.5	3.672	88.64	1.800	.00	2.14	5.90	.0157	1.30-	.003-
374	016	0025	20	2	04	1184.36	1662.5	3.672	92.56	1.800	.00	.17	8.47	.0225	.76-	.126-
374	016	0026	20	2	04	1184.17	1662.5	3.672	87.30	1.800	.00	1.17	7.13	.0190	1.10-	.058-
374	016	0027	20	2	04	1184.05	1662.5	3.671	88.85	1.800	.00	2.14	5.87	.0156	1.07-	.002-
374	016	0028	20	2	04	1184.68	1662.5	3.673	88.52	1.800	.00	3.13	5.39	.0143	1.23-	.016
374	016	0029	20	2	04	1184.72	1662.5	3.673	88.31	1.800	.00	4.13	5.76	.0153	1.05-	.002
374	016	0030	20	2	04	1184.48	1662.5	3.673	87.50	1.800	.00	5.11	5.87	.0156	.91-	.002-
374	016	0031	20	2	04	1184.84	1662.5	3.674	108.45	1.800	.00	5.11	5.88	.0156	.86-	.002
374	016	0032	20	2	04	1184.52	1662.5	3.673	79.31	1.800	.00	5.11	5.88	.0156	1.01-	.005-
374	016	0033	20	2	04	1184.24	1662.5	3.672	85.91	1.800	.00	358.16	7.75	.0206	.96-	.089-
374	016	0034	20	2	04	1184.20	1662.5	3.672	86.53	1.800	.00	356.10	8.37	.0223	.63-	.122-
374	016	0035	20	2	04	1184.52	1662.5	3.673	283.05	1.800	.00	354.10	8.19	.0218	.12	.112-
374	016	0036	20	2	04	1184.28	1662.5	3.672	87.71	1.800	.00	353.14	5.25	.0140	.39-	.021
374	016	0037	20	2	04	1184.32	1662.5	3.672	95.29	1.800	.00	353.65	7.16	.0190	.21-	.058-
374	016	0038	20	2	04	1184.20	1662.5	3.672	85.00	1.800	.00	356.10	8.39	.0223	.56-	.124-
374	016	0039	20	2	04	1184.24	1662.5	3.672	89.05	1.800	.00	357.15	7.27	.0193	1.18-	.064-
374	016	0040	20	2	04	1184.20	1662.5	3.672	88.76	1.800	.00	358.14	7.71	.0205	.94-	.086-
374	016	0041	20	2	04	1184.60	1662.5	3.673	87.01	1.800	.00	357.13	7.23	.0192	1.21-	.063-
374	016	0042	20	2	04	1184.56	1662.5	3.673	85.18	1.800	.00	359.15	8.54	.0227	.88-	.133-
374	016	0043	20	2	04	1184.36	1662.5	3.672	87.87	1.800	.00	.17	8.47	.0225	.85-	.128-

JUN 13 1962

NASA
Langley Research Ce
Langley Station
Hampton, Virginia

PRELIMINARY
CONFIDENTIAL
NATIONAL AERONAUTICS AND

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	017	0046	20	2	04	1253.20	1767.5	3.951	68.01	2.000	.00	7.06	1.73	.0043	.18-	.098
374	017	0047	20	2	04	1253.09	1767.5	3.950	86.91	2.000	.00	6.08	4.87	.0122	.49-	.032
374	017	0048	20	2	04	1253.09	1767.5	3.950	88.58	2.000	.00	4.13	4.69	.0117	1.25-	.037
374	017	0049	20	2	04	1253.34	1767.5	3.951	89.45	2.000	.00	5.11	5.23	.0131	1.13-	.020
374	017	0051	20	2	04	1253.52	1767.5	3.952	88.88	2.000	.00	3.13	4.94	.0123	1.49-	.030
374	017	0052	20	2	04	1253.02	1767.5	3.950	89.45	2.000	.00	2.12	5.96	.0149	1.20-	.005-
374	017	0053	20	2	04	1252.59	1767.5	3.949	89.95	2.000	.00	.17	5.99	.0150	1.49-	.006-
374	017	0055	20	2	04	1252.59	1767.5	3.949	89.51	2.000	.00	1.13	6.33	.0158	1.33-	.019-
374	017	0056	20	2	04	1251.84	1767.5	3.946	89.97	2.000	.00	359.15	6.73	.0168	1.35-	.036-
374	017	0057	20	2	04	1252.91	1767.5	3.950	89.54	2.000	.00	358.16	6.91	.0173	1.26-	.044-
374	017	0058	20	2	04	1252.55	1767.5	3.949	89.21	2.000	.00	356.12	7.31	.0183	.79-	.062-
374	017	0059	20	2	04	1252.41	1767.5	3.948	88.87	2.000	.00	354.12	7.56	.0189	.20-	.074-
374	017	0060	20	2	04	1252.94	1767.5	3.950	91.87	2.000	.00	352.14	1.37	.0034	2.52-	.103
374	017	0061	20	2	04	1253.12	1767.5	3.950	88.22	2.000	.00	353.12	5.30	.0132	.44-	.017

NASA
Langley Research C
Langley Station
Hampton, Virginia

JUN 16 62

CONFIDENTIAL

PRELIMINARY

CONFIDENTIAL

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP
374	018	0064	20	2	04	897.12	2017.9	2.918	289.33
374	018	0065	20	2	04	896.79	2017.9	2.917	290.71
374	018	0066	20	2	04	896.76	2017.9	2.917	281.19
374	018	0067	20	2	04	897.53	2017.9	2.920	270.23
374	018	0068	20	2	04	896.46	2017.9	2.916	296.50
374	018	0069	20	2	04	895.94	2017.9	2.914	271.67
374	018	0070	20	2	04	898.07	2017.9	2.921	277.79
374	018	0071	20	2	04	897.10	2017.9	2.918	254.84
374	018	0072	20	2	04	897.17	2017.9	2.918	247.95
374	018	0073	20	2	04	896.33	2017.9	2.916	278.76
374	018	0074	20	2	04	896.48	2017.9	2.916	261.70
374	018	0075	20	2	04	896.92	2017.9	2.918	311.54
374	018	0076	20	2	04	897.25	2017.9	2.919	293.77
374	018	0077	20	2	04	896.46	2017.9	2.916	292.93

MACH	AOS	AOA	FREQ	K	CMQ	CMA
2.500	.00	7.06	3.01	.0066	.32	.110
2.500	.00	6.10	3.27	.0071	.09-	.103
2.500	.00	4.15	5.45	.0119	.23-	.018
2.500	.00	2.12	5.83	.0128	.15	.000-
2.500	.00	.15	3.55	.0078	.42-	.095
2.500	.00	358.16	5.54	.0121	.26-	.013
2.500	.00	356.12	5.87	.0128	.27-	.003-
2.500	.00	354.12	3.02	.0066	.13-	.109
2.500	.00	353.12	1.37	.0030	.05-	.143
2.500	.00	357.26	5.87	.0128	.15-	.002-
2.500	.00	1.13	5.08	.0111	.15-	.035
2.500	.00	.17	3.34	.0073	.13-	.102
2.500	.00	359.17	3.73	.0081	.37-	.089
2.500	.00	358.16	5.32	.0116	.29-	.025

NASA
Langley Research C
Langley Station
Hampton, Virginia

PRELIMINARY

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	019	0080	20	2	04	800.41	2100.6	2.772	88.89	2.750	.00	7.08	3.78	.0079	.80-	.098
374	019	0081	20	2	04	800.55	2100.6	2.773	94.88	2.750	.00	8.04	3.16	.0066	.78-	.120
374	019	0082	20	2	04	800.38	2100.6	2.772	79.12	2.750	.00	6.10	3.76	.0079	.85-	.098
374	019	0083	20	2	04	800.70	2100.6	2.773	93.95	2.750	.00	4.15	4.59	.0096	.29-	.064
374	019	0084	20	2	04	801.18	2100.6	2.775	83.51	2.750	.00	2.14	4.89	.0103	.03	.049
374	019	0085	20	2	04	800.72	2100.6	2.773	275.00	2.750	.00	1.15	6.12	.0129	.47	.017-
374	019	0086	20	2	04	801.02	2100.6	2.774	293.79	2.750	.00	.17	5.41	.0114	.33	.022
374	019	0087	20	2	04	801.00	2100.6	2.774	272.47	2.750	.00	359.17	5.82	.0122	.52	.000
374	019	0088	20	2	04	800.55	2100.6	2.773	90.47	2.750	.00	358.16	4.95	.0104	.06-	.047
374	019	0089	20	2	04	800.70	2100.6	2.773	92.18	2.750	.00	356.12	4.27	.0090	.82-	.078
374	019	0090	20	2	04	800.93	2100.6	2.774	90.77	2.750	.00	354.12	3.07	.0064	1.07-	.122
374	019	0091	20	2	04	800.62	2100.6	2.773	84.40	2.750	.00	352.12	3.44	.0072	.45-	.110
374	019	0092	20	2	04	800.72	2100.6	2.773	278.54	2.750	.00	.15	5.43	.0114	.33	.021

NASA
Langley Research Ce
Langley Station
Hampton, Virginia

PRELIMINARY
NATIONAL AERONAUTICS AND

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	020	0096	20	2	04	181.57	2100.6	.628	83.86	2.750	.00	8.04	5.59	.0118	1.09-	.057
374	020	0097	20	2	04	182.05	2100.6	.630	77.11	2.750	.00	6.08	5.60	.0118	.68-	.054
374	020	0098	20	2	04	182.39	2100.6	.631	78.83	2.750	.00	4.13	6.02	.0127	.39-	.051-
374	020	0099	20	2	04	182.09	2100.6	.630	93.35	2.750	.00	2.14	5.64	.0119	1.15-	.048
374	020	0100	20	2	04	182.09	2100.6	.630	90.41	2.750	.00	1.15	5.13	.0108	1.55-	.167
374	020	0101	20	2	04	181.99	2100.6	.630	82.83	2.750	.00	.17	4.94	.0104	2.35-	.206

NASA
Langley Research
Langley Station
Hampton, Virginia

[redacted]

CONFIDENTIAL

PRELIMINARY

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	021	0005	20	2	05	340.80	1662.5	1.056	288.72	1.800	.00	.17	7.15	.0190	.22	.201-
374	021	0006	20	2	05	341.23	1662.5	1.058	242.86	1.800	.00	2.14	7.18	.0191	.19	.205-
374	021	0007	20	2	05	340.92	1662.5	1.057	99.04	1.800	.00	4.15	5.87	.0156	.48-	.004-
374	021	0008	20	2	05	341.15	1662.5	1.057	116.59	1.800	.00	6.08	4.35	.0116	1.00-	.182
374	021	0009	20	2	05	341.83	1662.5	1.060	139.29	1.800	.00	8.04	3.04	.0081	1.00-	.299
374	021	0010	20	2	05	339.18	1662.5	1.051	260.55	1.800	.00	358.14	7.76	.0206	.75	.307-
374	021	0011	20	2	05	338.90	1662.5	1.050	25.99	1.800	.00	356.10	6.89	.0183	.11	.160-
374	021	0012	20	2	05	338.98	1662.5	1.051	109.88	1.800	.00	354.12	5.04	.0134	.70-	.105
374	021	0013	20	2	05	339.18	1662.5	1.051	94.22	1.800	.00	352.12	3.68	.0098	.66-	.241
374	021	0014	20	2	05	339.73	1662.5	1.053	103.43	1.800	.00	351.12	2.56	.0068	1.53-	.325
374	021	0015	20	2	05	340.29	1662.5	1.055	233.71	1.800	.00	1.15	7.34	.0195	.32	.231-
374	021	0016	20	2	05	340.64	1662.5	1.056	235.66	1.800	.00	.15	7.13	.0190	.30	.196-

NASA
Langley Researcl
Langley Station
Hampton, Virgin

FR LIMINARY

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	022	0019	20	2	05	181.36	2100.6	.628	105.27	2.750	.00	.15	4.97	.0104	1.71-	.210
374	022	0020	20	2	05	181.42	2100.6	.628	141.41	2.750	.00	4.13	6.05	.0127	.31-	.047-
374	022	0021	20	2	05	181.78	2100.6	.629	76.78	2.750	.00	358.16	5.46	.0115	1.04-	.087
374	022	0022	20	2	05	181.34	2100.6	.628	124.42	2.750	.00	356.10	6.00	.0126	.09-	.041-
374	022	0023	20	2	05	181.44	2100.6	.628	112.45	2.750	.00	354.10	5.63	.0118	.44-	.053
374	022	0024	20	2	05	181.57	2100.6	.628	58.85	2.750	.00	352.14	5.64	.0119	.44-	.041
374	022	0025	20	2	05	181.50	2100.6	.628	89.58	2.750	.00	350.13	5.37	.0113	.99-	.107
374	022	0026	20	2	05	181.44	2100.6	.628	98.77	2.750	.00	348.14	4.68	.0098	1.75-	.268
374	022	0027	20	2	05	181.46	2100.6	.628	100.13	2.750	.00	346.14	4.18	.0088	1.58-	.366
374	022	0028	20	2	05	181.55	2100.6	.628	109.39	2.750	.00	344.12	3.95	.0083	.67-	.407

JUN 13 1962

NASA
Langley Research Ce
Langley Station
Hampton, Virginia

CONFIDENTIAL
PRELIMINARY
NATIONAL AERONAUTICS AND

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	023	0015	22	2	06	1183.81	1662.5	3.671	97.28	1.800	.00	.17	11.16	.0297	.52-	.242-
374	023	0016	22	2	06	1186.26	1662.5	3.678	93.82	1.800	.00	2.14	9.50	.0253	.91-	.143-
374	023	0017	22	2	06	1184.95	1662.5	3.674	102.75	1.800	.00	4.15	6.79	.0181	1.33-	.011-
374	023	0018	22	2	06	1184.72	1662.5	3.673	165.78	1.800	.00	6.08	2.32	.0061	1.55-	.140
374	023	0019	22	2	06	1184.17	1662.5	3.672	88.44	1.800	.00	5.11	4.83	.0128	1.24-	.048
374	023	0020	22	2	06	1184.92	1662.5	3.674	102.54	1.800	.00	358.14	11.19	.0298	.20-	.244-
374	023	0021	22	2	06	1184.68	1662.5	3.673	104.55	1.800	.00	356.12	9.71	.0259	.33-	.154-
374	023	0022	22	2	06	1184.68	1662.5	3.673	89.64	1.800	.00	354.10	6.24	.0166	.91-	.003
374	023	0023	22	2	06	1184.92	1662.5	3.674	93.18	1.800	.00	353.10	3.17	.0084	1.08-	.087

JUN 13 1962

NASA
Langley Research C
Langley Station
Hampton, Virginia

PRELIMINARY

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	024	0026	22	2	06	1254.73	1767.5	3.955	92.19	2.000	.00	.15	10.93	.0274	.48-	.216-
374	024	0027	22	2	06	1254.41	1767.5	3.954	93.83	2.000	.00	2.14	9.47	.0237	.90-	.133-
374	024	0028	22	2	06	1254.84	1767.5	3.956	91.88	2.000	.00	4.15	6.88	.0172	1.46-	.018-
374	024	0029	22	2	06	1253.70	1767.5	3.952	127.30	2.000	.00	5.98	1.82	.0045	1.80-	.107
374	024	0030	22	2	06	1253.70	1767.5	3.952	141.67	2.000	.00	5.98	3.00	.0075	2.04-	.105
374	024	0031	22	2	06	1253.45	1767.5	3.951	103.71	2.000	.00	358.14	10.85	.0272	.41-	.209-
374	024	0032	22	2	06	1252.77	1767.5	3.949	87.51	2.000	.00	356.12	9.27	.0232	.58-	.125-
374	024	0033	22	2	06	1253.84	1767.5	3.953	91.05	2.000	.00	354.10	6.65	.0166	.90-	.010-
374	024	0034	22	2	06	1253.27	1767.5	3.951	99.08	2.000	.00	353.12	4.53	.0113	1.02-	.055

JUN 13 1962

NASA
Langley Research C
Langley Station
Hampton, Virginia

CONFIDENTIAL
PRELIMINARY

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	025	0008	30	2	07	1185.55	1662.5	3.676	95.74	1.800	.00	.17	13.90	.0370	.09-	.021-
374	025	0009	30	2	07	1185.27	1662.5	3.675	100.44	1.800	.00	2.14	13.77	.0367	.19-	.017-
374	025	0010	30	2	07	1185.67	1662.5	3.676	95.28	1.800	.00	4.17	13.42	.0357	.23-	.011-
374	025	0011	30	2	07	1186.10	1662.5	3.678	89.33	1.800	.00	6.01	13.53	.0360	.19-	.014-
374	025	0012	30	2	07	1185.90	1662.5	3.677	92.16	1.800	.00	8.04	13.55	.0361	.23-	.014-
374	025	0013	30	2	07	1185.98	1662.5	3.677	77.47	1.800	.00	358.14	13.34	.0355	.10-	.011-
374	025	0014	30	2	07	1186.06	1662.5	3.677	95.86	1.800	.00	356.12	12.65	.0337	.14-	.003
374	025	0015	30	2	07	1185.78	1662.5	3.677	102.24	1.800	.00	354.10	12.09	.0322	.21-	.014
374	025	0016	30	2	07	1186.53	1662.5	3.679	98.31	1.800	.00	352.14	12.08	.0322	.13-	.013
374	025	0017	30	2	07	1186.42	1662.5	3.679	95.71	1.800	.00	350.13	11.87	.0316	.25-	.017
374	025	0018	30	2	07	1186.22	1662.5	3.678	97.39	1.800	.00	348.12	11.95	.0318	.25-	.016
374	025	0019	30	2	07	1186.34	1662.5	3.678	86.65	1.800	.00	346.14	12.08	.0322	.04-	.012
374	025	0020	30	2	07	1186.57	1662.5	3.679	85.65	1.800	.00	344.12	12.22	[redacted]	[redacted]	[redacted]

NASA
Langley Research C
Langley Station
Hampton, Virginia

JUN 13 1962

CONFIDENTIAL

PRELIMINARY

NATIONAL AERONAUTICS AND

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CMQ	CMA
374	026	0023	30	2	07	1253.30	1767.5	3.951	89.16	2.000	.00	.17	15.26	.0382	.09-	.047-
374	026	0024	30	2	07	1253.52	1767.5	3.952	96.21	2.000	.00	2.12	15.27	.0383	.10-	.047-
374	026	0025	30	2	07	1253.87	1767.5	3.953	79.69	2.000	.00	4.15	14.97	.0375	.12-	.042-
374	026	0027	30	2	07	1254.16	1767.5	3.954	89.34	2.000	.00	8.04	13.72	.0344	.28-	.017-
374	026	0028	30	2	07	1254.02	1767.5	3.953	94.80	2.000	.00	358.14	15.17	.0380	.10-	.045-
374	026	0029	30	2	07	1254.05	1767.5	3.953	94.86	2.000	.00	356.10	14.86	.0372	.10-	.039-
374	026	0030	30	2	07	1254.20	1767.5	3.954	85.77	2.000	.00	354.12	14.06	.0352	.18-	.023-
374	026	0031	30	2	07	1254.30	1767.5	3.954	80.12	2.000	.00	352.14	13.22	.0331	.09-	.008-
374	026	0032	30	2	07	1253.55	1767.5	3.952	88.25	2.000	.00	350.13	12.51	.0313	.19-	.004
374	026	0033	30	2	07	1254.05	1767.5	3.953	91.98	2.000	.00	348.12	11.83	.0296	.22-	.016
374	026	0034	30	2	07	1253.70	1767.5	3.952	78.47	2.000	.00	346.14	11.85	.0297	.10-	.015
374	026	0035	30	2	07	1253.98	1767.5	3.953	69.52	2.000	.00	344.12	12.24	[redacted]	[redacted]	[redacted]

JUN 13 1962

NASA
Langley Research
Langley Station
Hampton, Virgini

[redacted]

PRELIMINARY

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP
374	027	0005	10	4	08	736.71	1662.5	2.284	87.52
374	027	0006	10	4	08	736.51	1662.5	2.283	35.07
374	027	0007	10	4	08	736.71	1662.5	2.284	31.97
374	027	0008	10	4	08	736.98	1662.5	2.285	88.58
374	027	0009	10	4	08	737.30	1662.5	2.286	05.64
374	027	0010	10	4	08	737.26	1662.5	2.286	86.65
374	027	0011	10	4	08	737.34	1662.5	2.286	89.89
374	027	0012	10	4	08	737.38	1662.5	2.286	95.08
374	027	0013	10	4	08	736.39	1662.5	2.283	13.78
374	027	0014	10	4	08	736.35	1662.5	2.283	03.20
374	027	0015	10	4	08	736.67	1662.5	2.284	90.03
374	027	0016	10	4	08	736.47	1662.5	2.283	07.30
374	027	0017	10	4	08	736.51	1662.5	2.283	93.42
374	027	0018	10	4	08	736.51	1662.5	2.283	95.47

JUN 13 1962

MACH	AOS	AOA	FREQ	K	CNR	CNB
1.800	.00	149.85	14.27	.0380	.17-	.085
1.800	.00	133.94	13.80	.0368	.11	.064
1.800	.00	135.89	13.78	.0367	.06	.069
1.800	.00	137.84	13.95	.0372	.05	.073
1.800	.00	139.85	14.27	.0380	.02	.084
1.800	.00	141.82	14.18	.0378	.10-	.081
1.800	.00	143.83	14.26	.0380	.14-	.084
1.800	.00	145.87	14.29	.0381	.19-	.085
1.800	.00	147.87	14.31	.0381	.24-	.082
1.800	.00	149.85	14.29	.0381	.26-	.083
1.800	.00	151.86	14.55	.0388	.13-	.096
1.800	.00	153.85	14.53	.0387	.18-	.093
1.800	.00	155.85	14.39	.0383	.19-	.089
1.800	.00	157.88	14.41	.0384	.18-	.090

Langley Research Center
Langley Station
Hampton, Virginia

[redacted]

PRELIMINARY

PRJ	RUN	POINT	CONF	T	B	Q	V	RN	TP	MACH	AOS	AOA	FREQ	K	CNR	CNB
374	028	0021	10	4	08	787.38	1767.5	2.482	107.00	2.000	.00	133.94	13.90	.0348	.04-	.065
374	028	0022	10	4	08	787.09	1767.5	2.481	102.28	2.000	.00	135.89	13.92	.0349	.07-	.066
374	028	0023	10	4	08	787.66	1767.5	2.483	104.27	2.000	.00	137.84	14.09	.0353	.03-	.072
374	028	0024	10	4	08	787.41	1767.5	2.482	92.28	2.000	.00	139.85	14.06	.0352	.13-	.071
374	028	0025	10	4	08	787.63	1767.5	2.483	87.37	2.000	.00	141.84	14.17	.0355	.13-	.076
374	028	0026	10	4	08	787.41	1767.5	2.482	99.26	2.000	.00	143.83	14.32	.0359	.13-	.080
374	028	0027	10	4	08	787.41	1767.5	2.482	103.85	2.000	.00	145.87	14.47	.0363	.13-	.085
374	028	0028	10	4	08	787.41	1767.5	2.482	86.66	2.000	.00	147.87	14.27	.0358	.20-	.080
374	028	0029	10	4	08	787.41	1767.5	2.482	77.70	2.000	.00	149.85	14.30	.0358	.18-	.082
374	028	0030	10	4	08	787.20	1767.5	2.481	87.00	2.000	.00	151.88	14.38	.0360	.22-	.084
374	028	0031	10	4	08	787.59	1767.5	2.483	80.32	2.000	.00	153.85	14.57	.0365	.18-	.092
374	028	0032	10	4	08	787.34	1767.5	2.482	98.28	2.000	.00	155.87	14.65	.0367	.21-	.092
374	028	0033	10	4	08	787.56	1767.5	2.483	87.00	2.000	.00	157.87	14.64	.0367	.22-	.094

JUN 13 1962

NASA
Langley Research Ce
Langley Station
Hampton, Virginia

PRELIMINARY
NATIONAL AERONAUTICS AND

[redacted]

APPENDIX "B"

[redacted]

INDEX OF FIGURES

Figure	Description	Page
1.	Launch Escape ($ET_{12}C$) and Command Module (C) Configuration Photograph	B-4
2.	Launch Escape ($E_{40}T_{15}C_2$) Configuration Photo	B-5
3.	Command Module - Oscillation Center Location Sketch	B-6
4.	Launch Escape Config. - Oscillation Center Location Sketch	B-7
	Dynamic Stability Parameters - Osc. in Pitch	
5.	Command Module (C), Entry Attitude	
	a. Effect of R. N. , M = 1.60	B-8
	b. " " , M = 1.80	B-9
	c. " " , M = 2.00	B-10
	d. " " , M = 2.50	B-11
6.	Command Module (C), Entry Attitude, 1.75" Spacer Effect of Mach No., (M=1.8 & 2.0)	B-12
7.	Launch Escape Config., (E_{35} T_{15} C_2 & E_{40} T_{15} C_2)	
	a. Effect of Rocket Disc, M = 1.80	B-13
	b. " " " " , M = 2.00	B-14
	c. " " " " , M = 2.50	B-15
	d. " " " " , M = 2.75	B-16
	e. Effect of R.N., Disc On, M = 1.80	B-17
	f. " " " " , M = 2.75	B-18
	g. Effect of R.N. Disc Off, M = 1.80	B-19
	h. " " " " M = 2.75	B-20
8.	Launch Escape Config., (E_4 T_{12} C_2) Effect of Mach No., (M = 1.8 & 2.0)	B-21
9.	Command Module (C_2), Exit Attitude, 1.21" Spacer Effect of Mach No., (M = 1.8 & 2.0)	B-22

[redacted] SID -62-1074

[redacted]

INDEX OF FIGURES - continued

Figure	Description	Page
	Dynamic Stability Parameters - Osc. in Yaw	
10.	Command Module (C), Entry Attitude Effect of Mach No., (M = 18. & 2.0)	B-23
	Typical Schlieren Photos at M = 1.80	
11.	a. Command Module (C), Entry Attitude	B-24
	b. Command Module (C_2), Exit Attude	B-25
	c. Launch Escape Config. (E_{35} T_{15} C_2), Disc Off	B-26
	d. Launch Escape Config. (E_{40} T_{15} C_2), Disc On	B-27

[redacted] SID-62-1074

CONFIDENTIAL

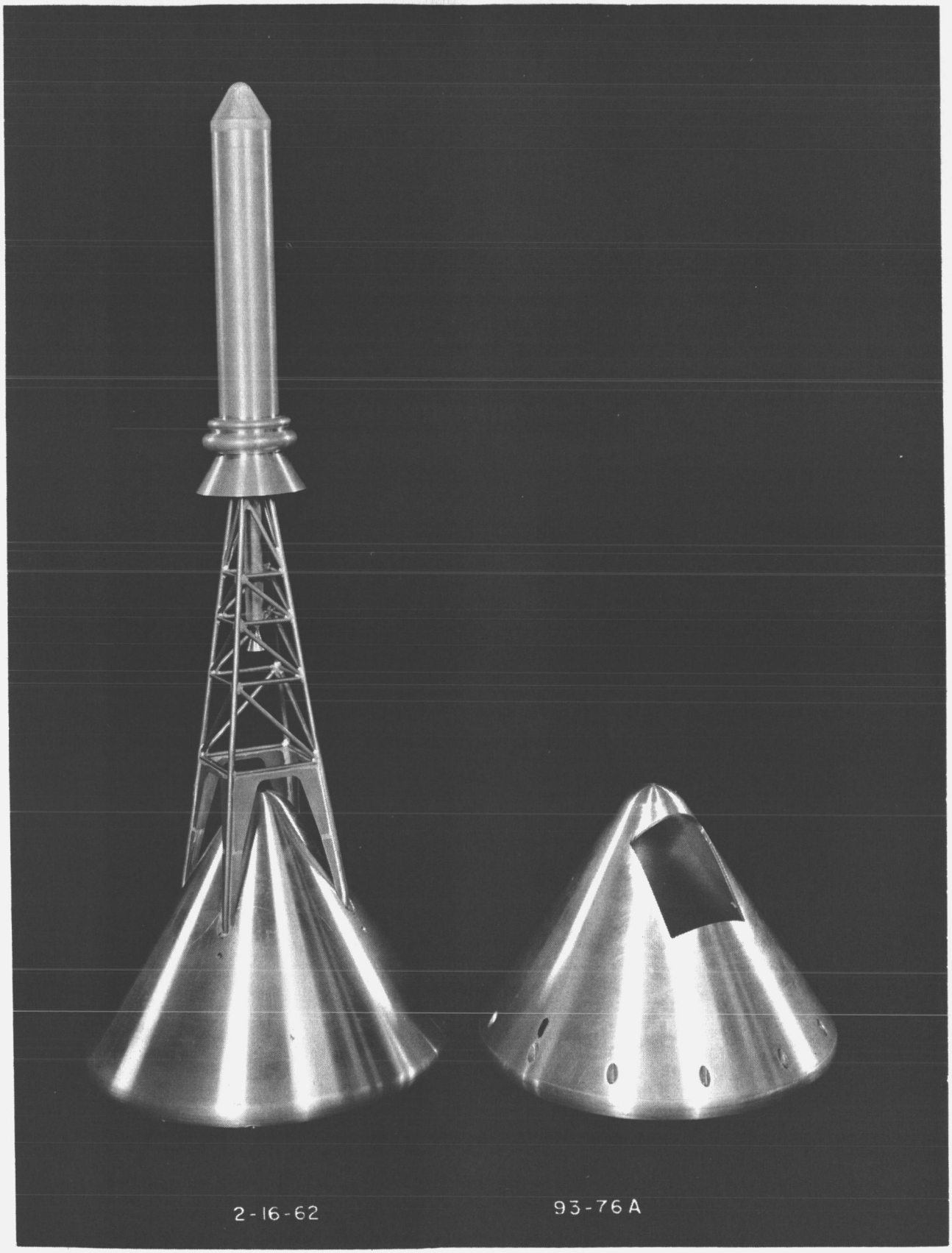


Fig. 1 Launch Escape Config. ($ET_{12}C$) & Command Module (C)
Note: Only Configuration $E_4T_{12}C$ was tested
(Same as above with toroid tanks on escape rocket removed)

CONFIDENTIAL

CONFIDENTIAL

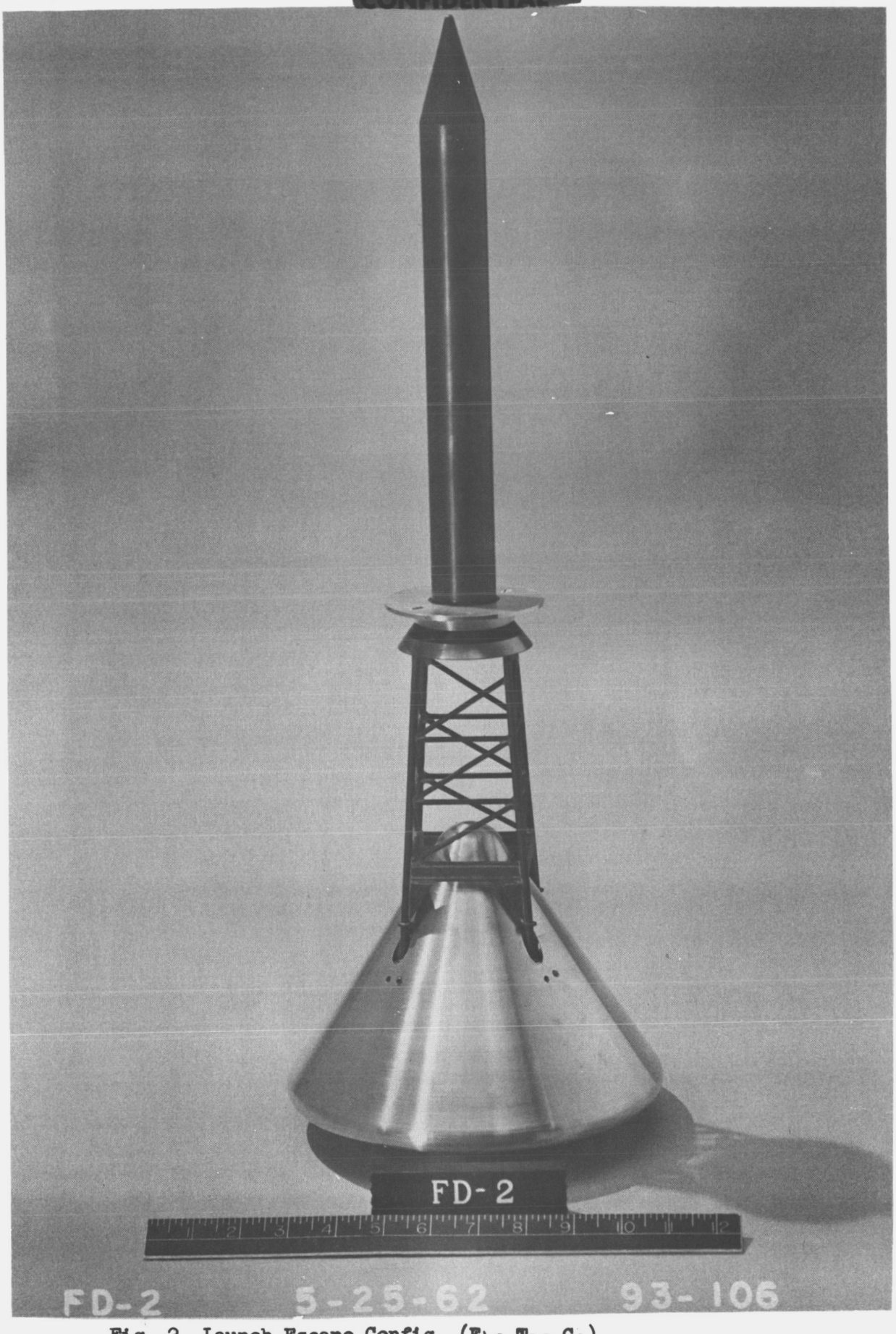


Fig. 2 Launch Escape Config. (E_{40} T_{15} C_2)

CONFIDENTIAL

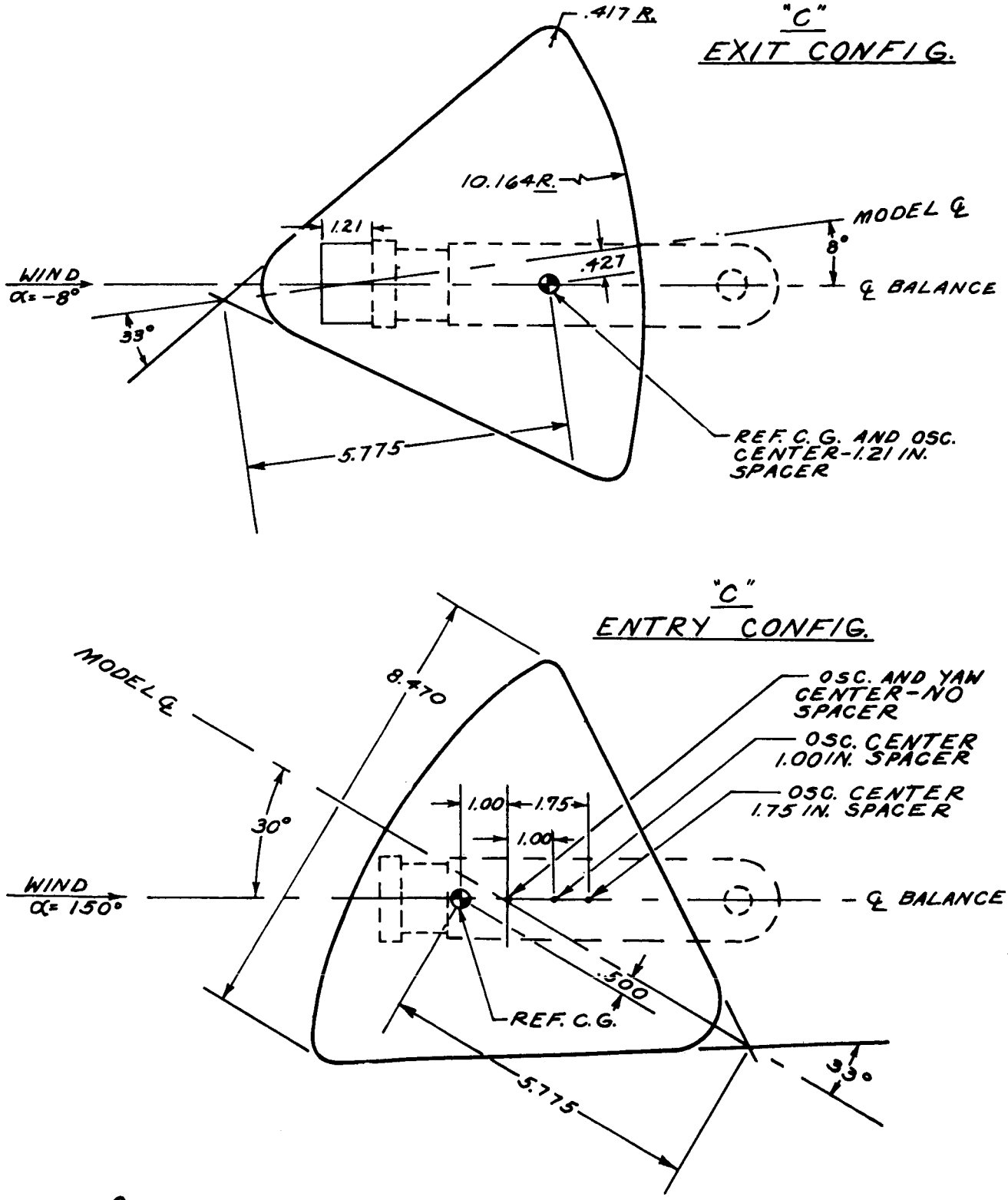
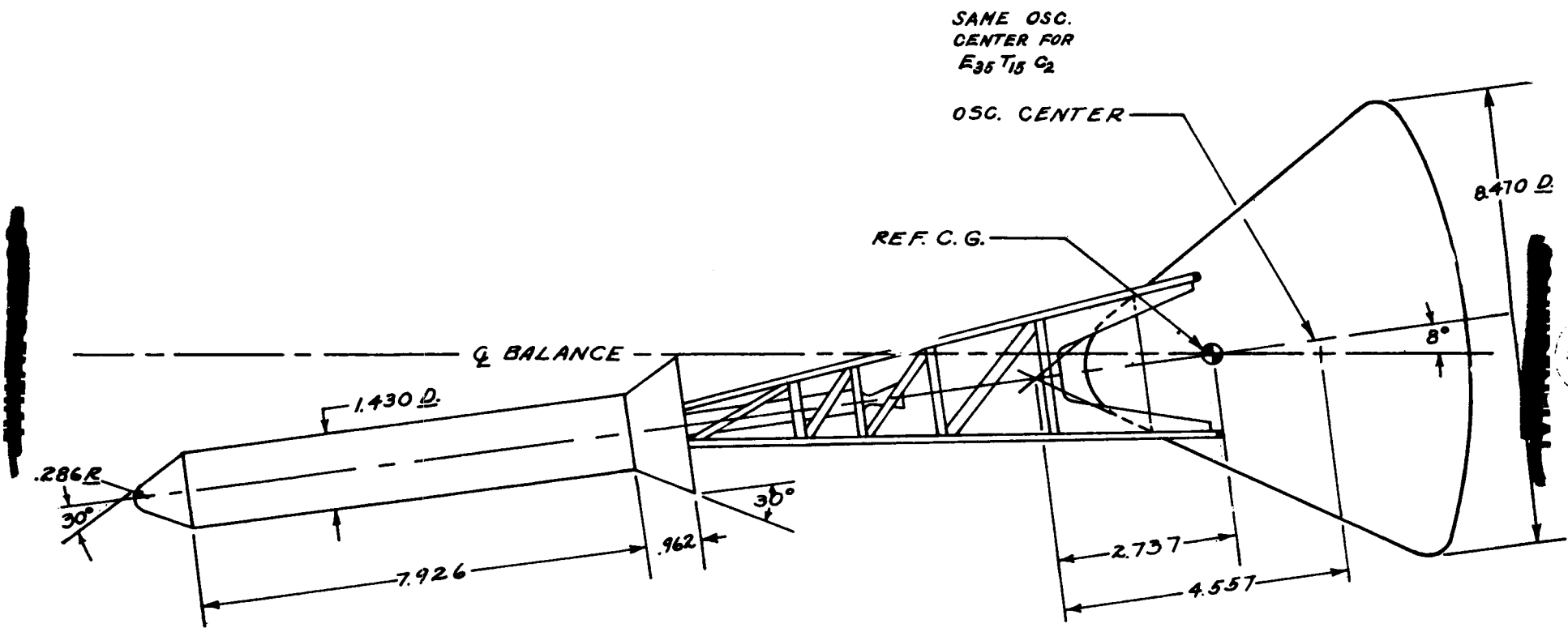


FIG. 3 - COMMAND MODULE OSCILLATION CENTER LOCATION



LAUNCH ESCAPE CONFIGURATION, $E_4 T_{12} C_2$
N.A.A. DWG. 7121-01058

ALL DIMENSIONS IN INCHES

FIG. 4 - LAUNCH ESCAPE CONFIG. OSCILLATION CENTER LOCATION

[redacted]

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

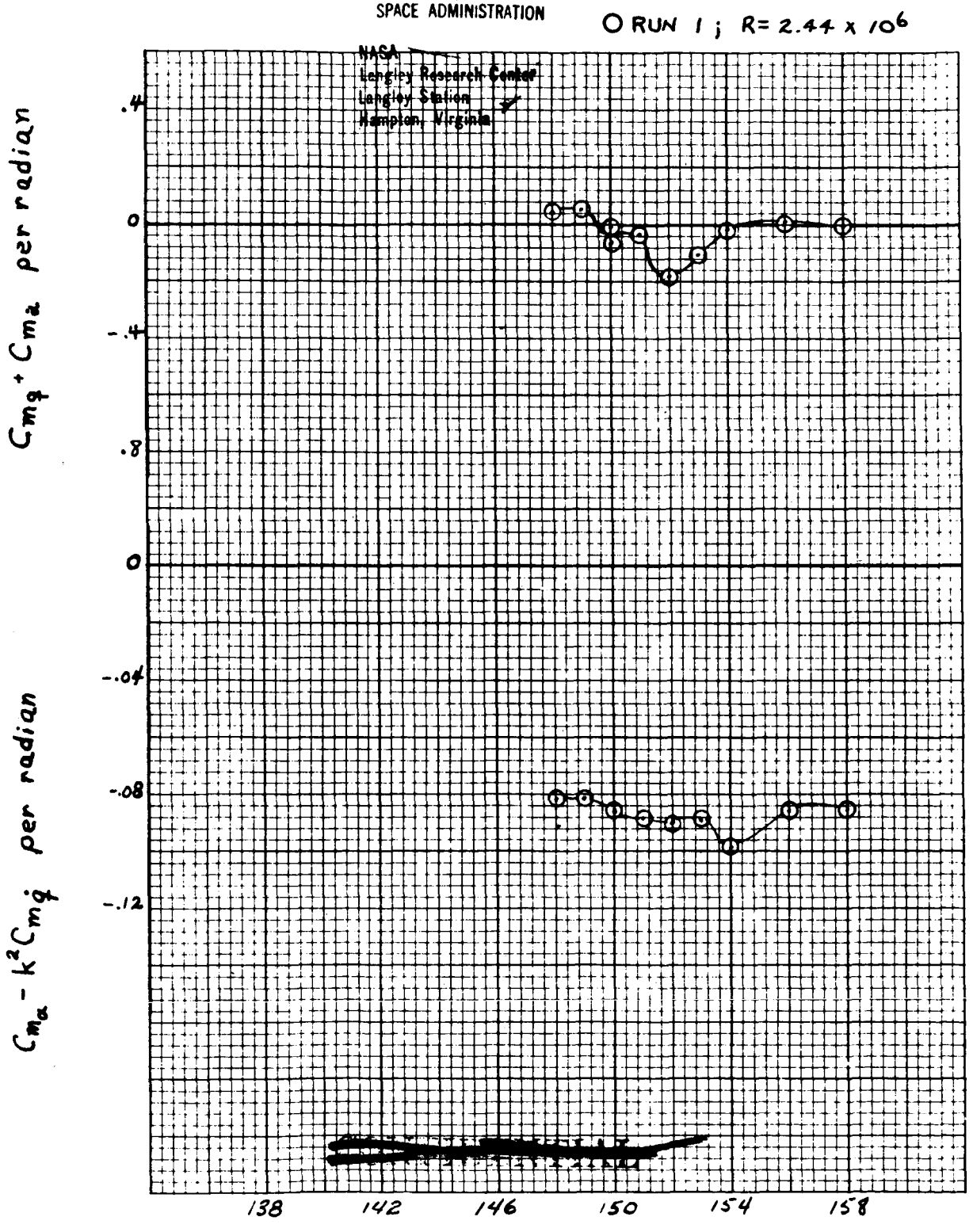
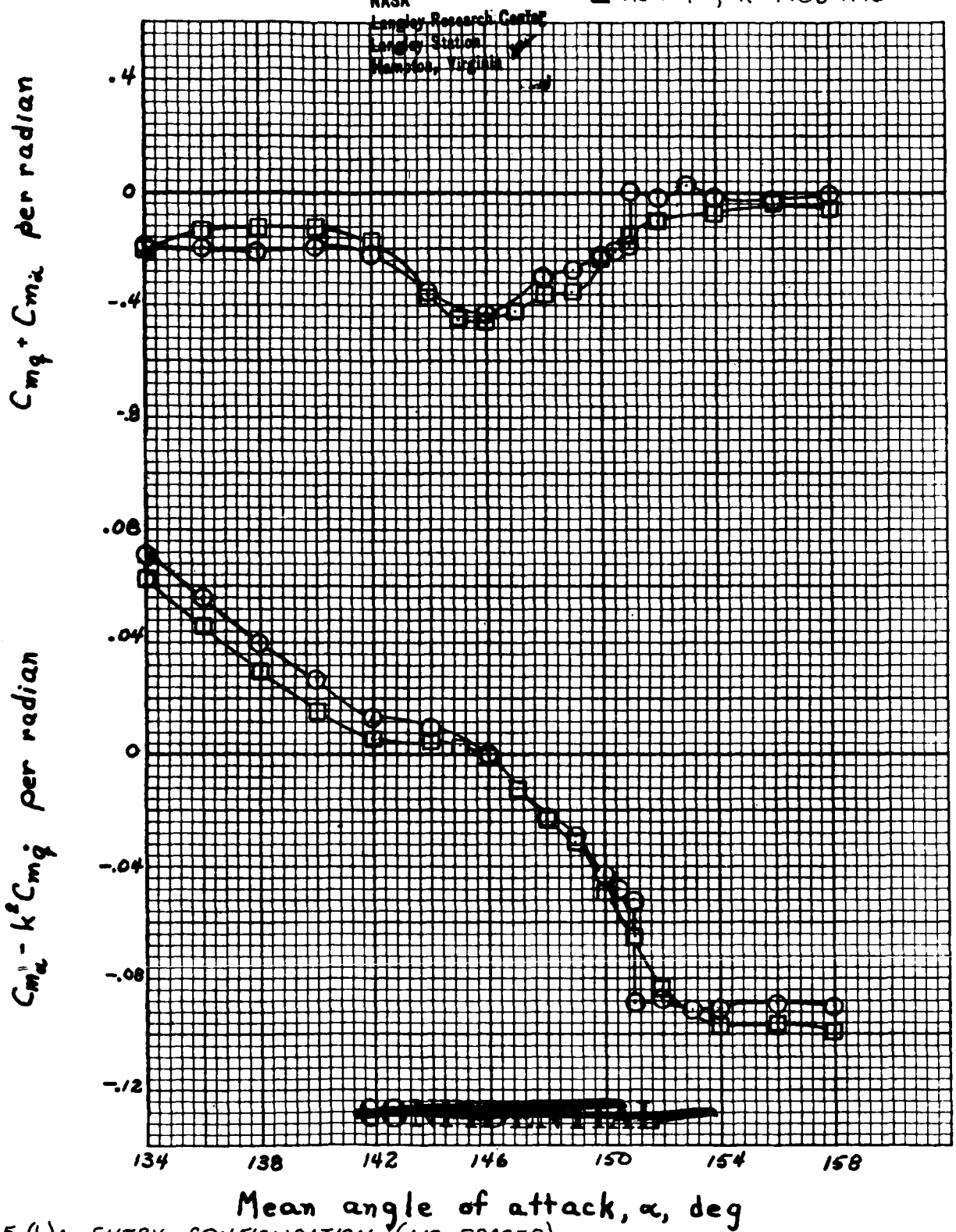


FIGURE 5 (a): VARIATION OF THE DAMPING-IN-PITCH PARAMETER AND THE OSCILLATORY LONGITUDINAL STABILITY PARAMETER WITH MEAN ANGLE OF ATTACK. ENTRY CONFIGURATION (NO SPACER) M = 1.60

[redacted]

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
NASA
Langley Research Center
Langley Station
Hampton, Virginia



[redacted]

FIGURE 5 (b): ENTRY CONFIGURATION (NO SPACER)
M = 1.80

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

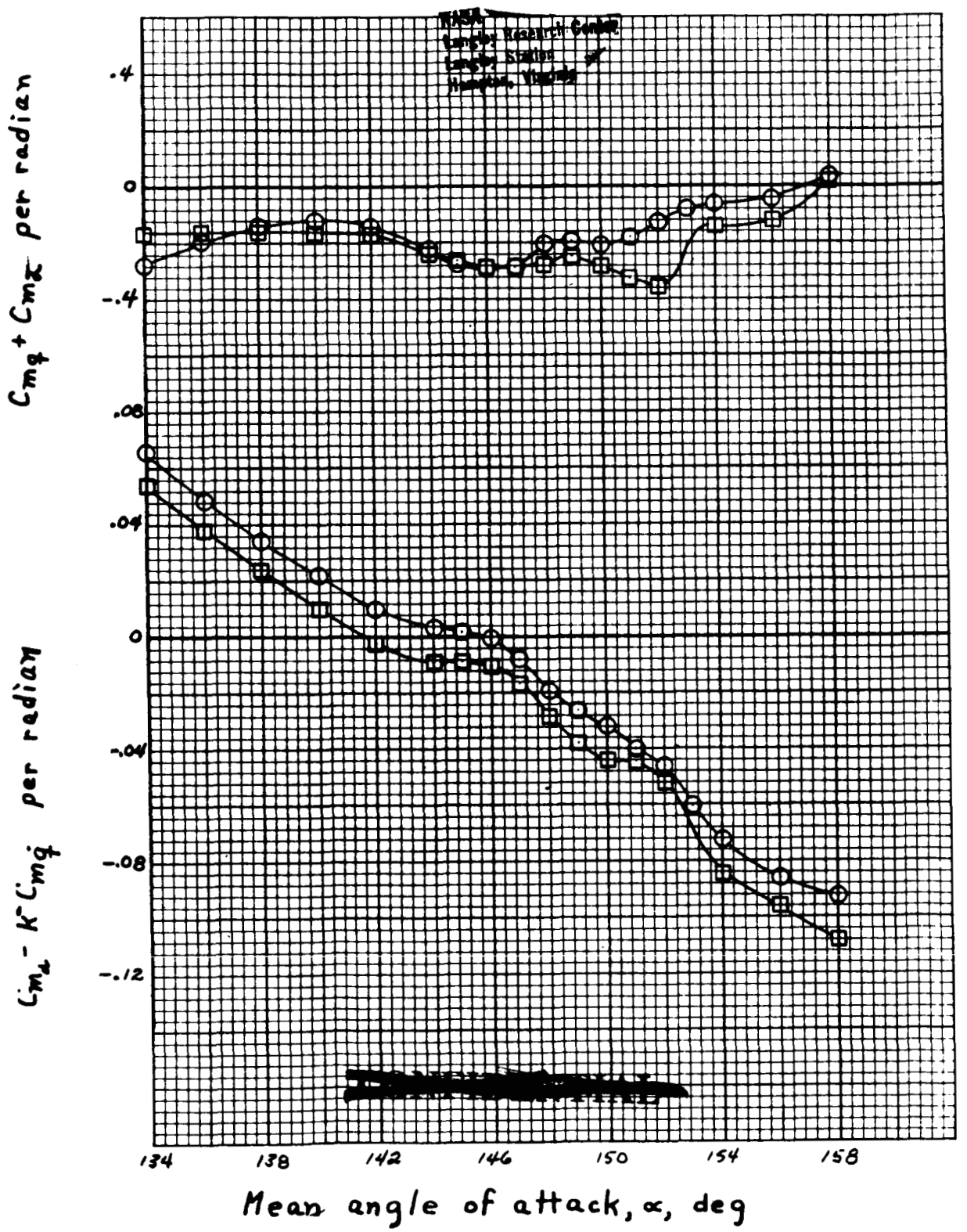
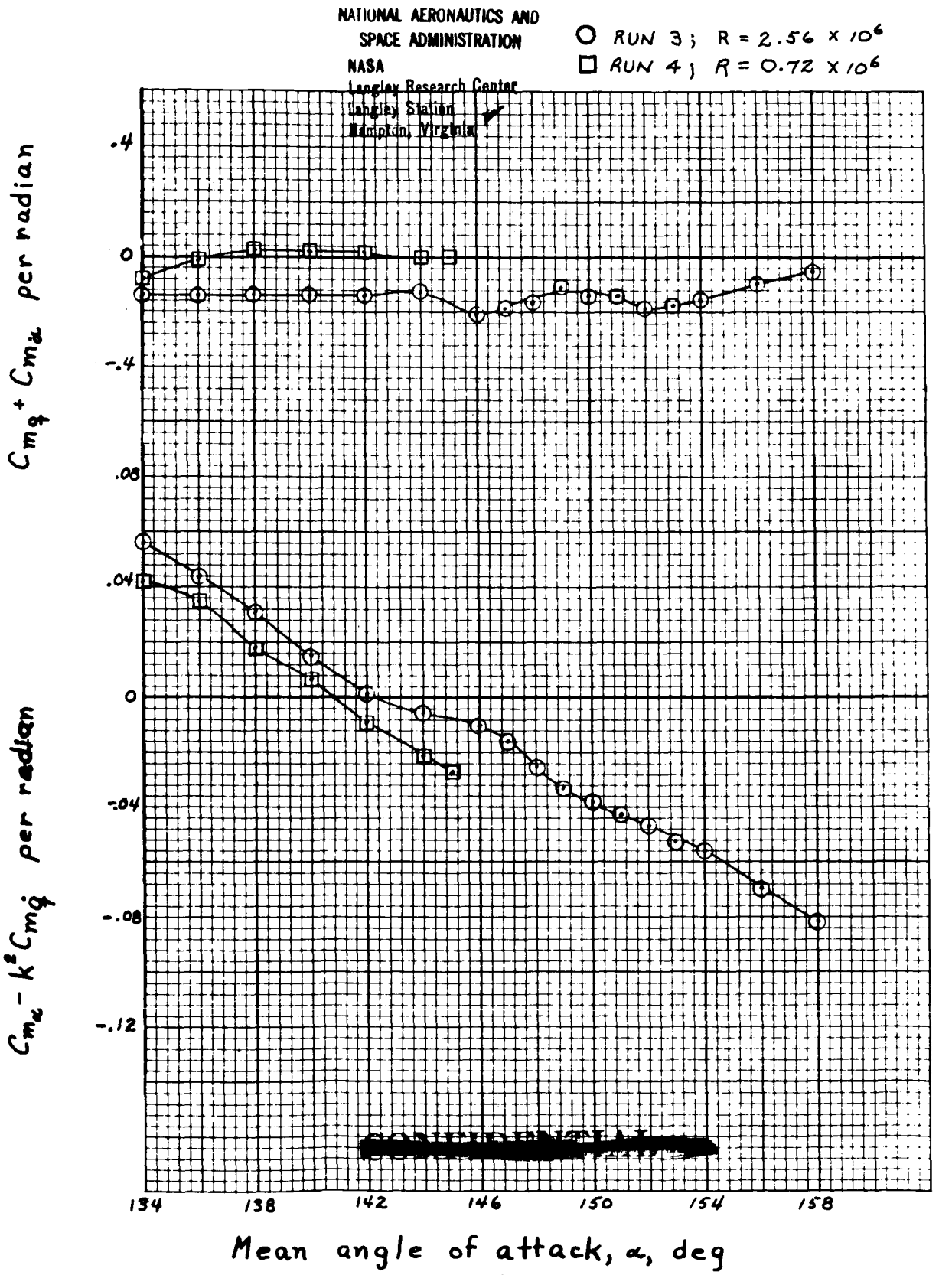


FIGURE 5 (c) : ENTRY CONFIGURATION (NO SPACER)
M = 2.00

[redacted]

PRELIMINARY



[redacted]

FIGURE 5 (d): ENTRY CONFIGURATION (NO SPACER)
M = 2.50

~~CONFIDENTIAL~~

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

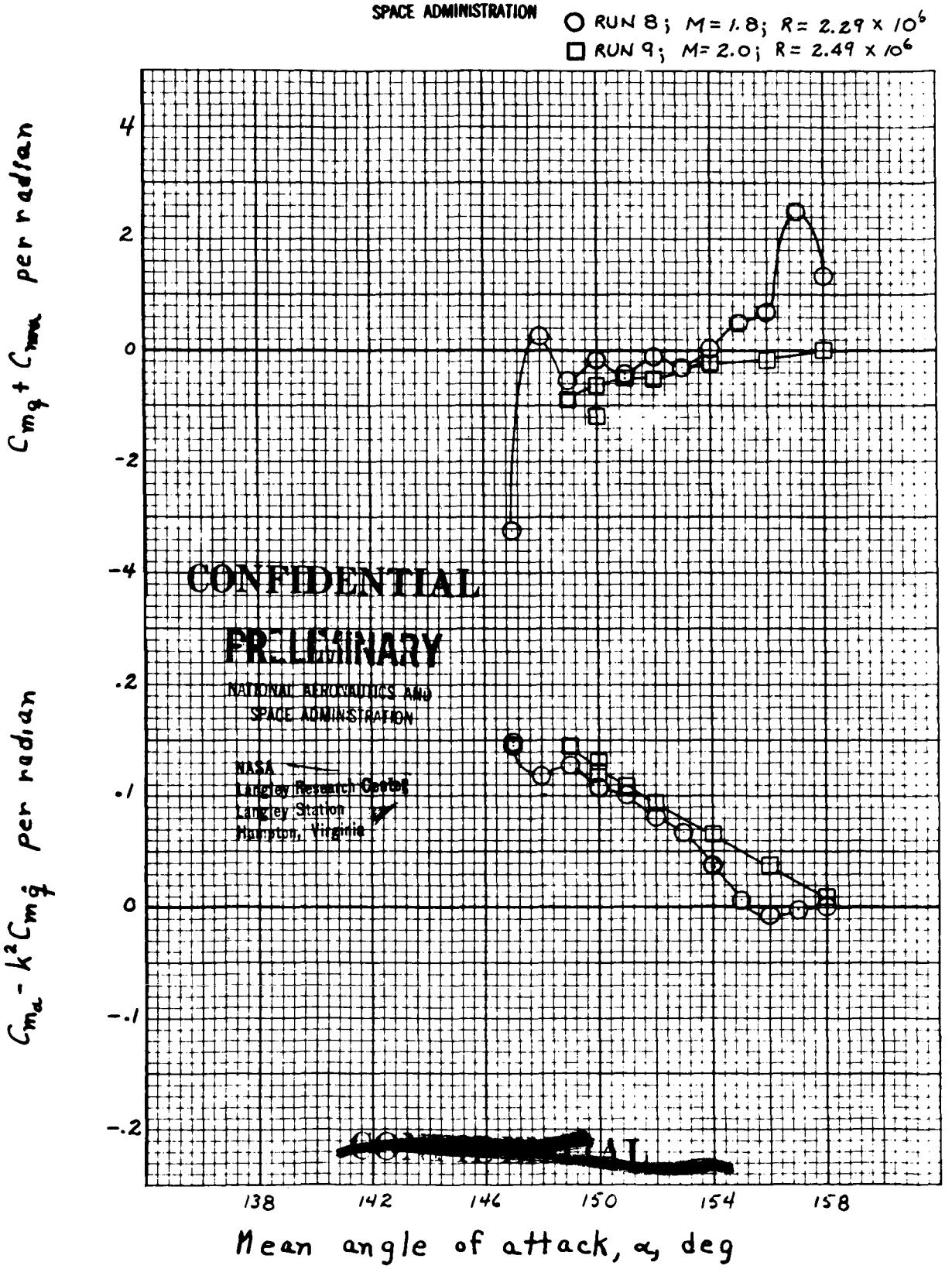
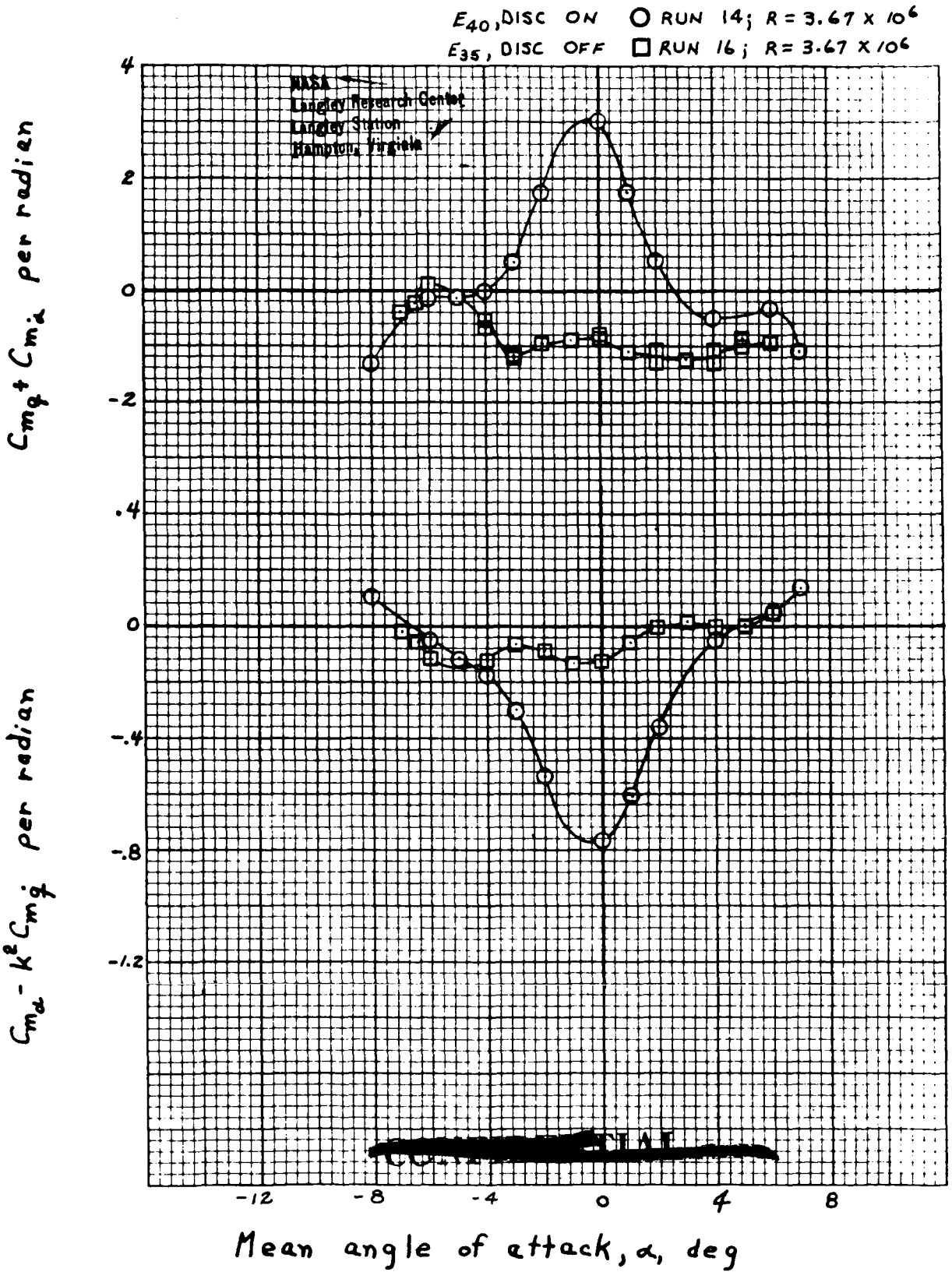


FIGURE 6 : VARIATION OF THE DAMPING-IN-PITCH PARAMETER AND THE OSCILLATORY LONGITUDINAL STABILITY PARAMETER WITH MEAN ANGLE OF ATTACK. ENTRY CONFIGURATION WITH 1.75 INCH SPACER M= 1.80 & 2.00

[redacted]

PRELIMINARY



[redacted]

FIGURE 7 (a): VARIATION OF THE DAMPING-IN-PITCH PARAMETER AND THE OSCILLATORY LONGITUDINAL STABILITY PARAMETER WITH MEAN ANGLE OF ATTACK. LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER), T_{15} C_2 M = 1.80

[redacted]

PRELIMINARY

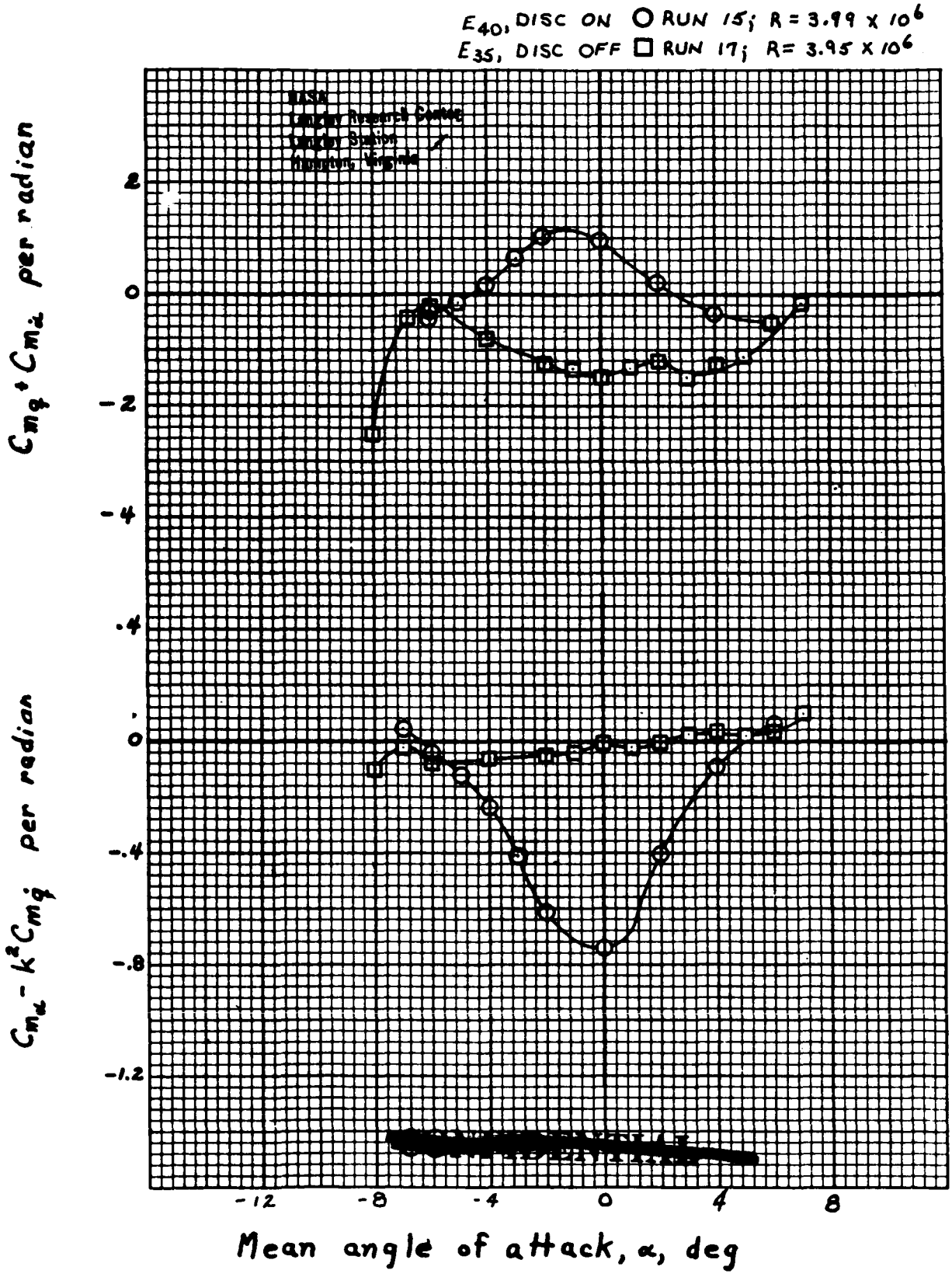


FIGURE 7(b): LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER)
M = 2.00

~~CONFIDENTIAL~~

PRELIMINARY

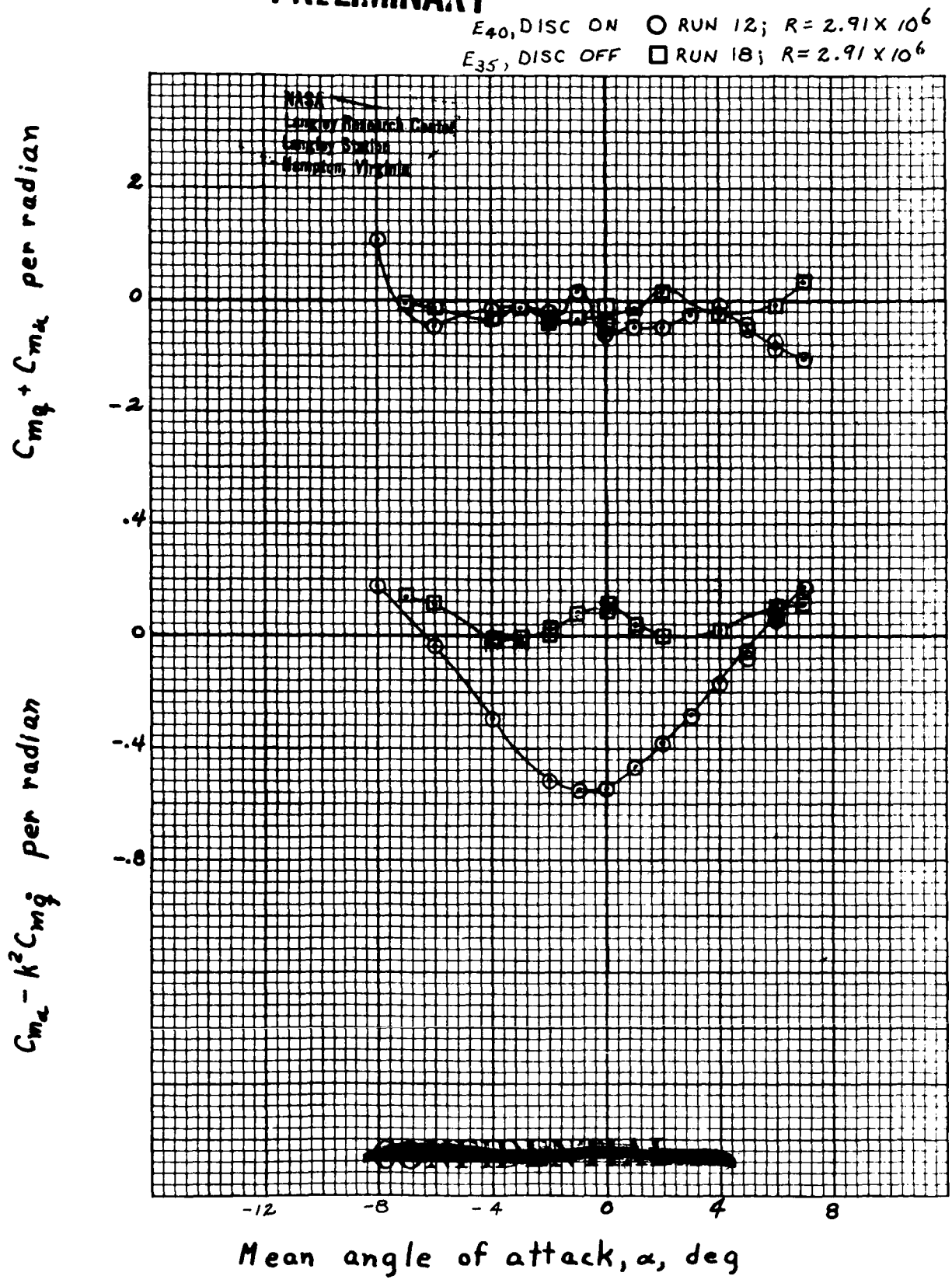
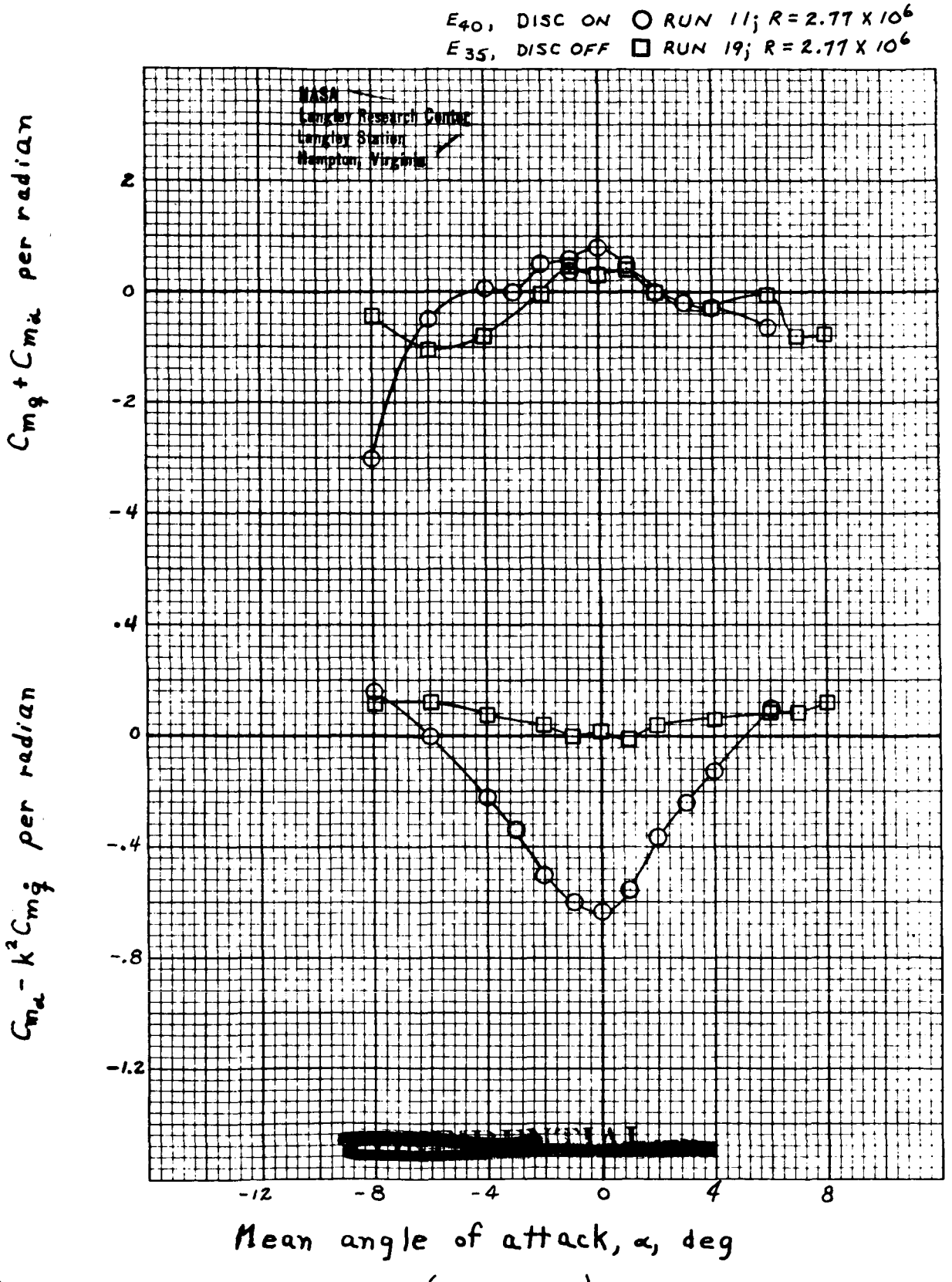


FIGURE 1(c): LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER)
M = 2.50

~~CONFIDENTIAL~~

PRELIMINARY

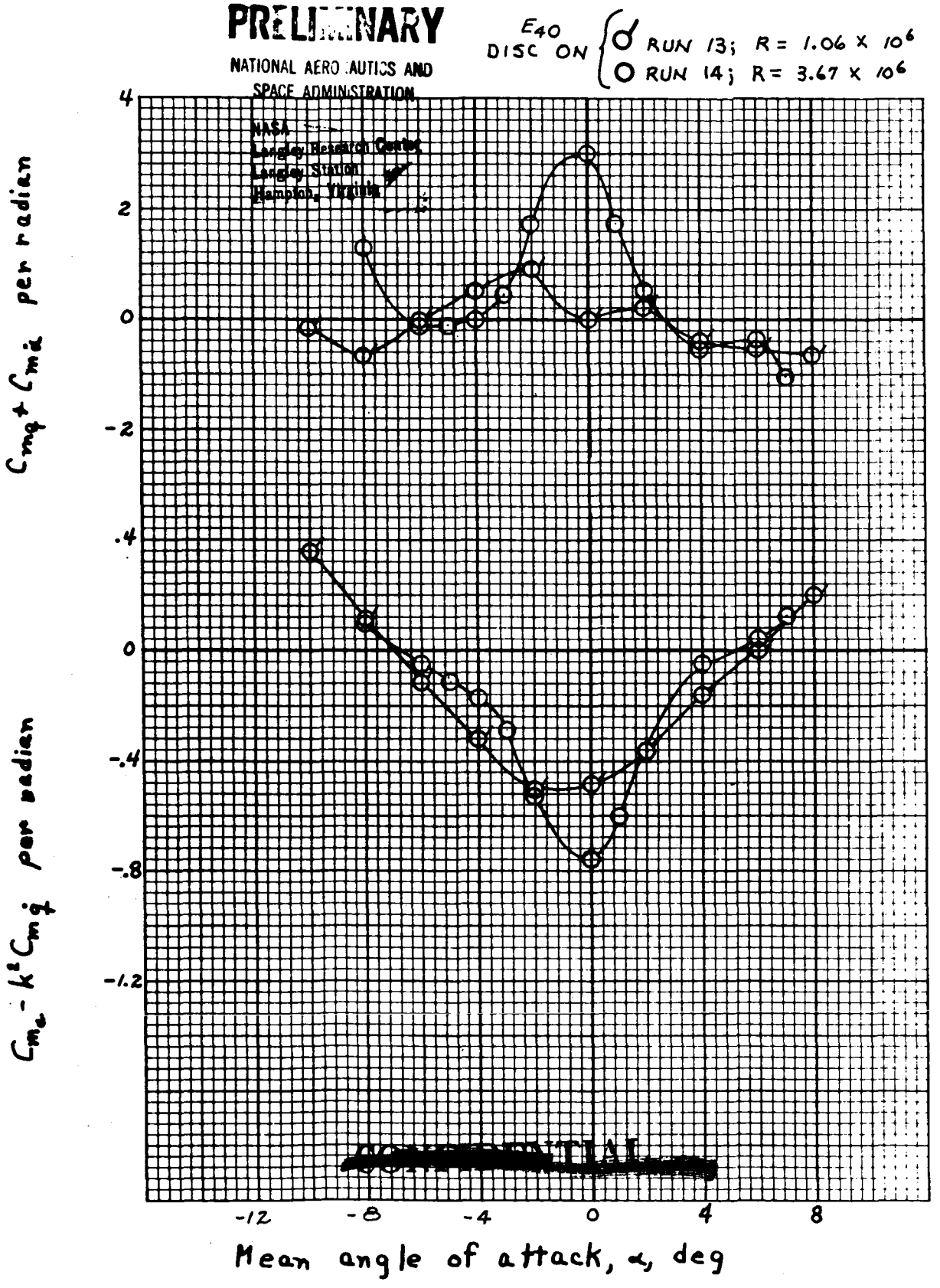


~~CONFIDENTIAL~~

FIGURE 7 (d): LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER)

$M = 2.75$

CONFIDENTIAL



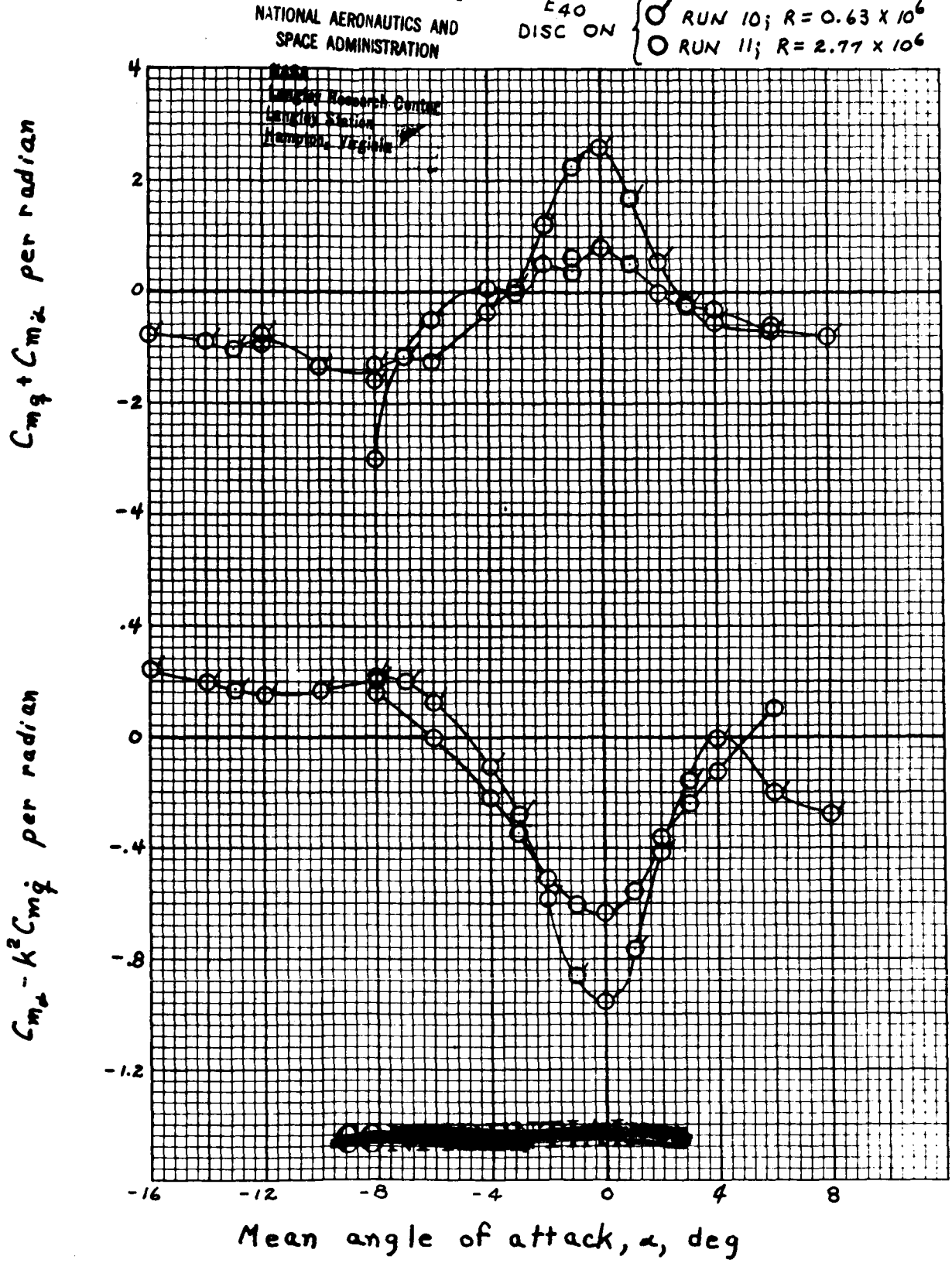
CONFIDENTIAL

FIGURE 7(e): LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER)
M = 1.80

[redacted]

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



[redacted]

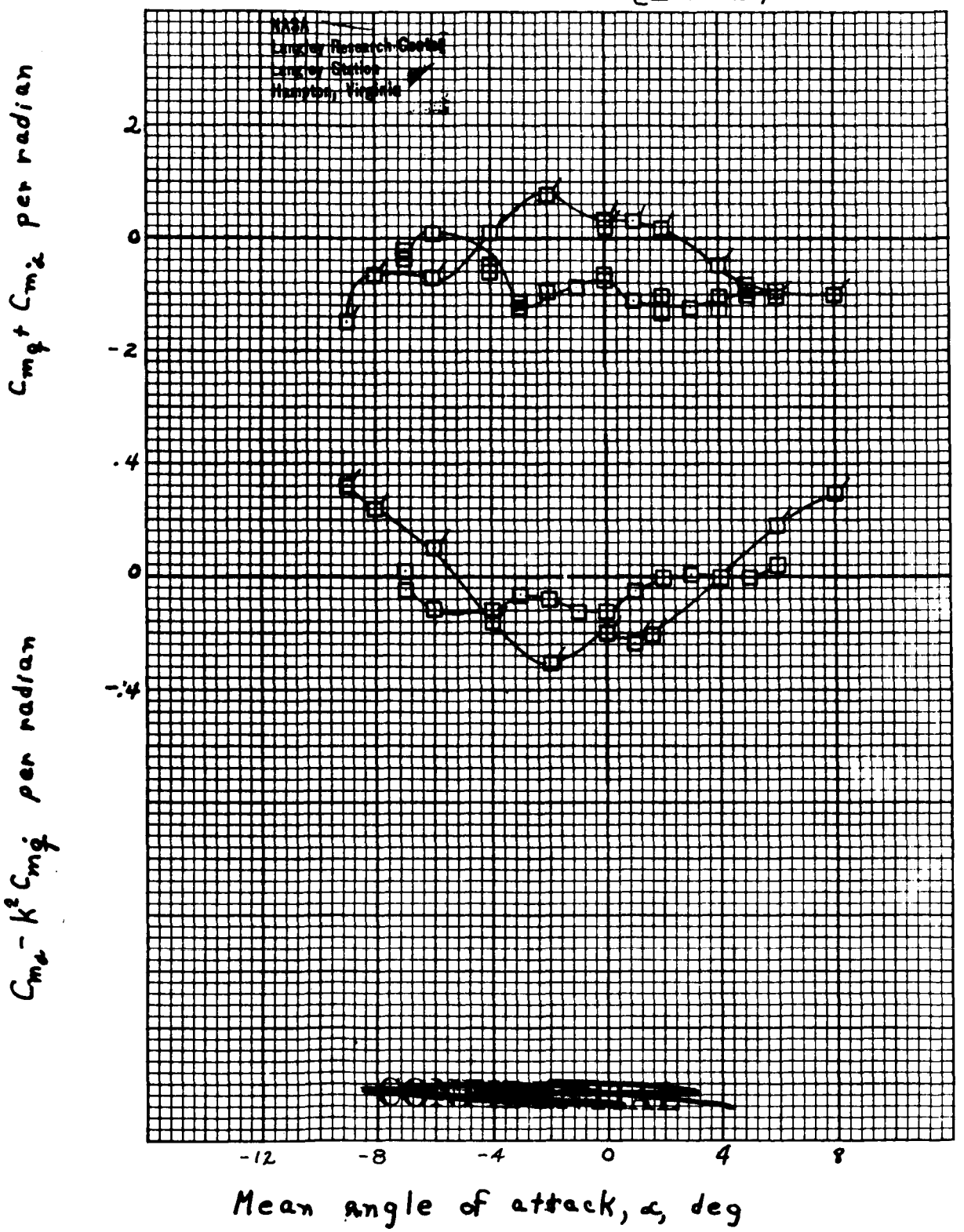
FIGURE 7 (f): LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER), $E_{40} T_{15} C_2$
$M = 2.75$

[redacted]

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

E_{35} DISC OFF { ☐ RUN 16; $R = 3.67 \times 10^6$ ☐ RUN 21; $R = 1.06 \times 10^6$



[redacted]

FIGURE 7 (8): LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER), $E_{35} T_{15} C_2$
$M = 1.80$

[redacted]

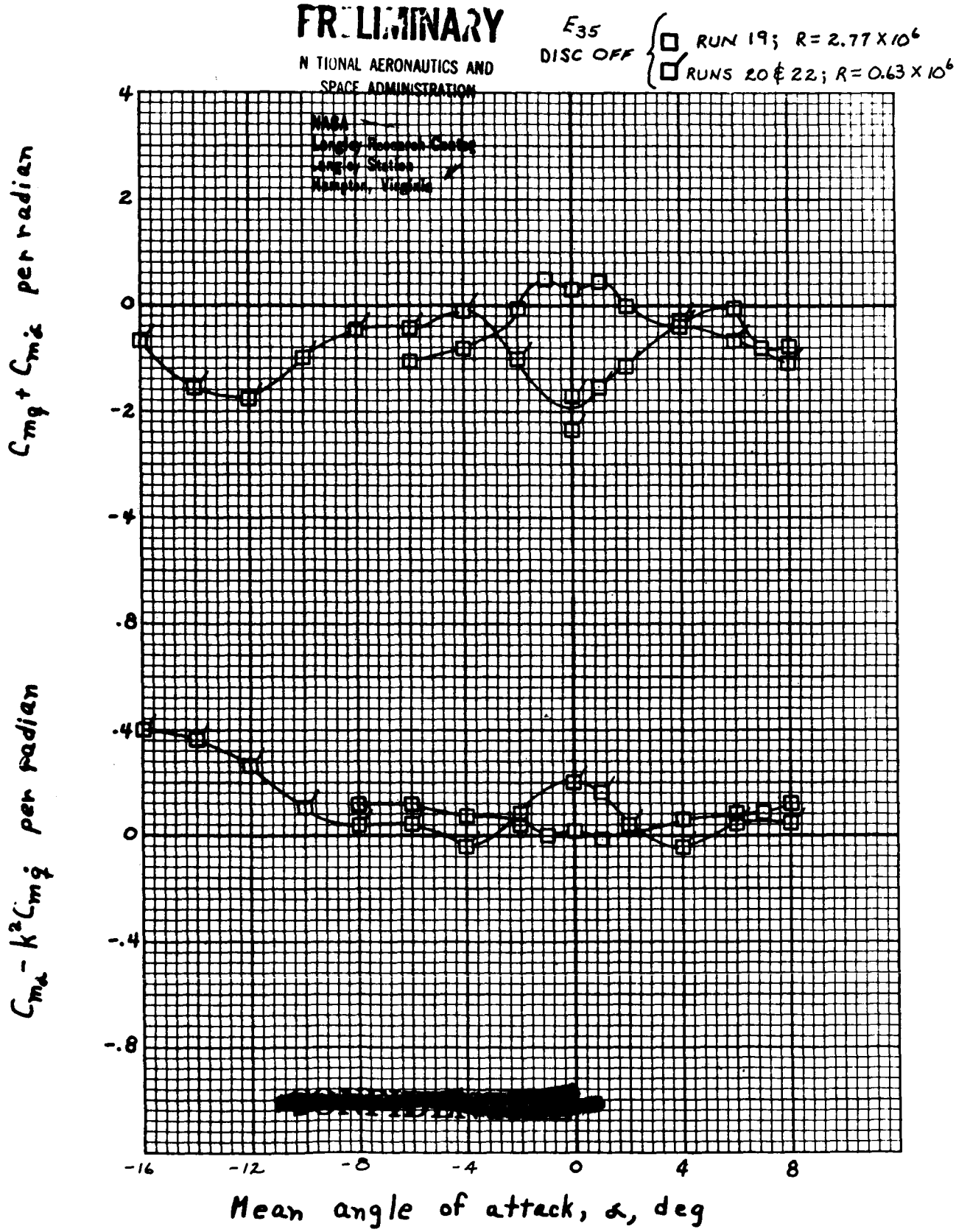


FIGURE 7 (h): LAUNCH-ESCAPE CONFIGURATION (SHORT TOWER), $E_{35} T_{15} C_2$
$M = 2.75$

[redacted]

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

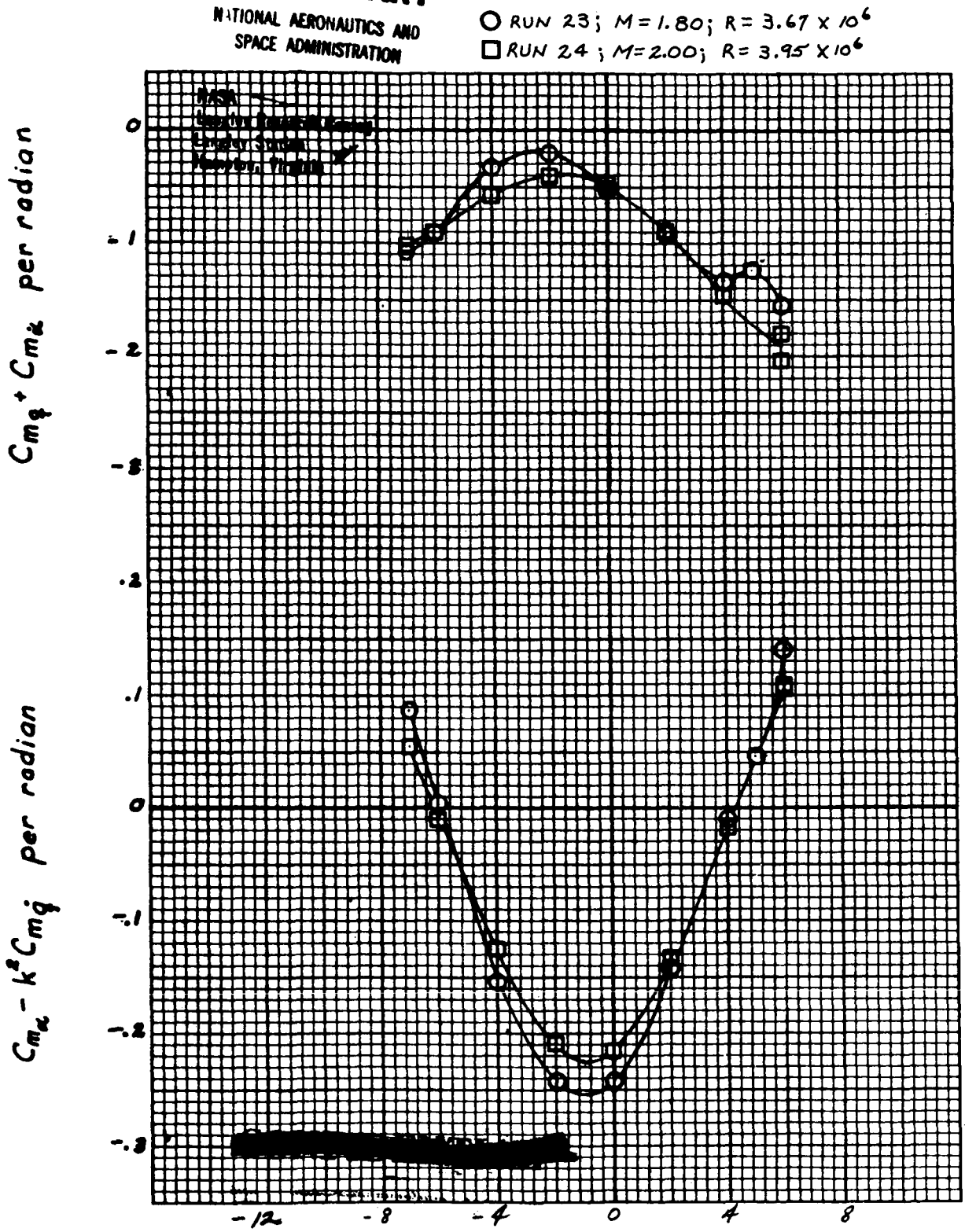


FIGURE 8 : VARIATION OF THE DAMPING-IN-PITCH PARAMETER AND THE OSCILLATORY LONGITUDINAL STABILITY PARAMETER WITH MEAN ANGLE OF ATTACK. LAUNCH-ESCAPE CONFIGURATION (LONG TOWER), $E_4 T_{12} C_2$ $M = 1.80$ & 2.00

~~CONFIDENTIAL~~

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

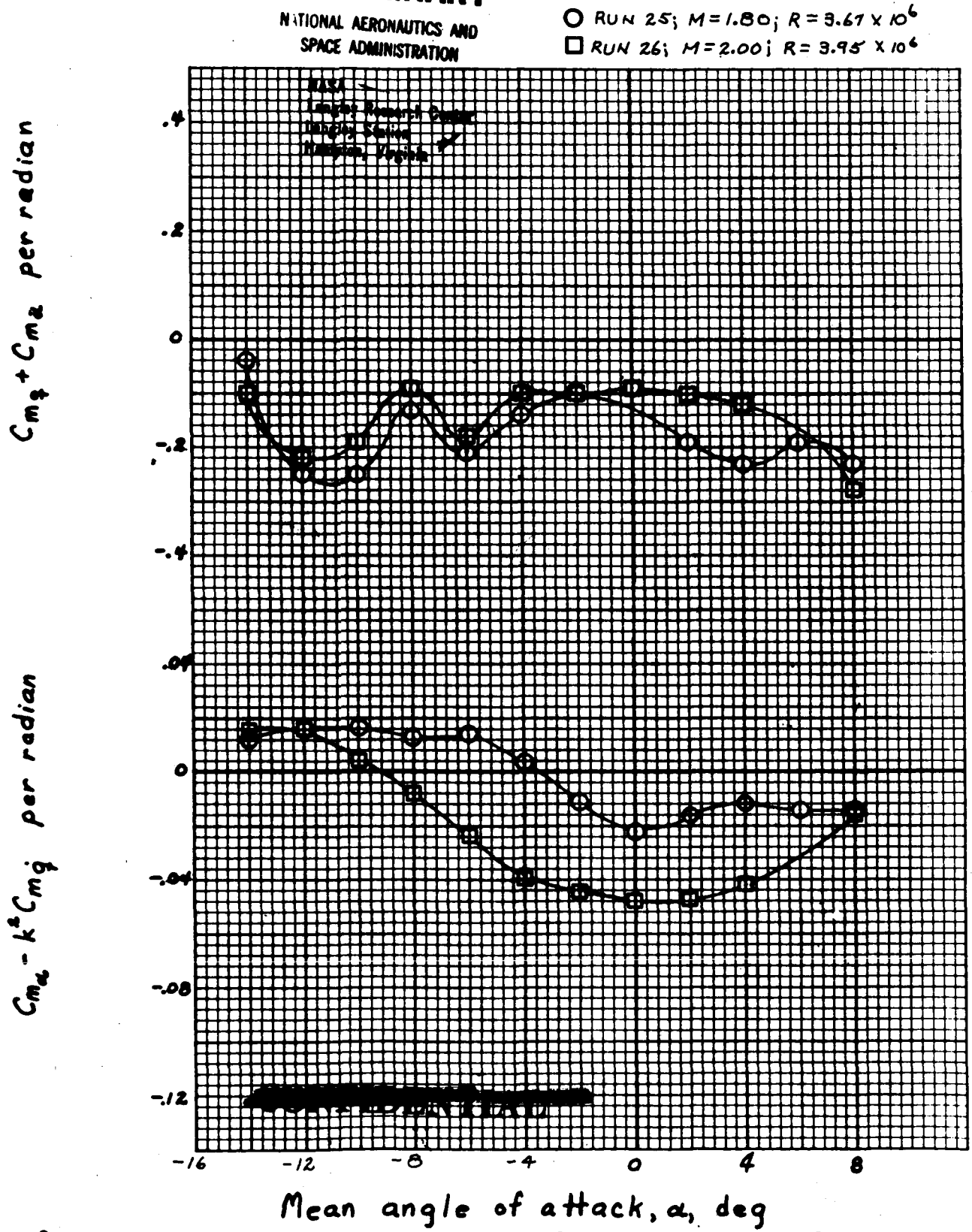


FIGURE 9 : VARIATION OF THE DAMPING-IN-PITCH PARAMETER AND THE OSCILLATORY LONGITUDINAL STABILITY PARAMETER WITH ANGLE OF ATTACK.
EXIT CONFIGURATION (HEAT SHIELD AFT)
M = 1.80 & 2.00

[redacted]

PRELIMINARY

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

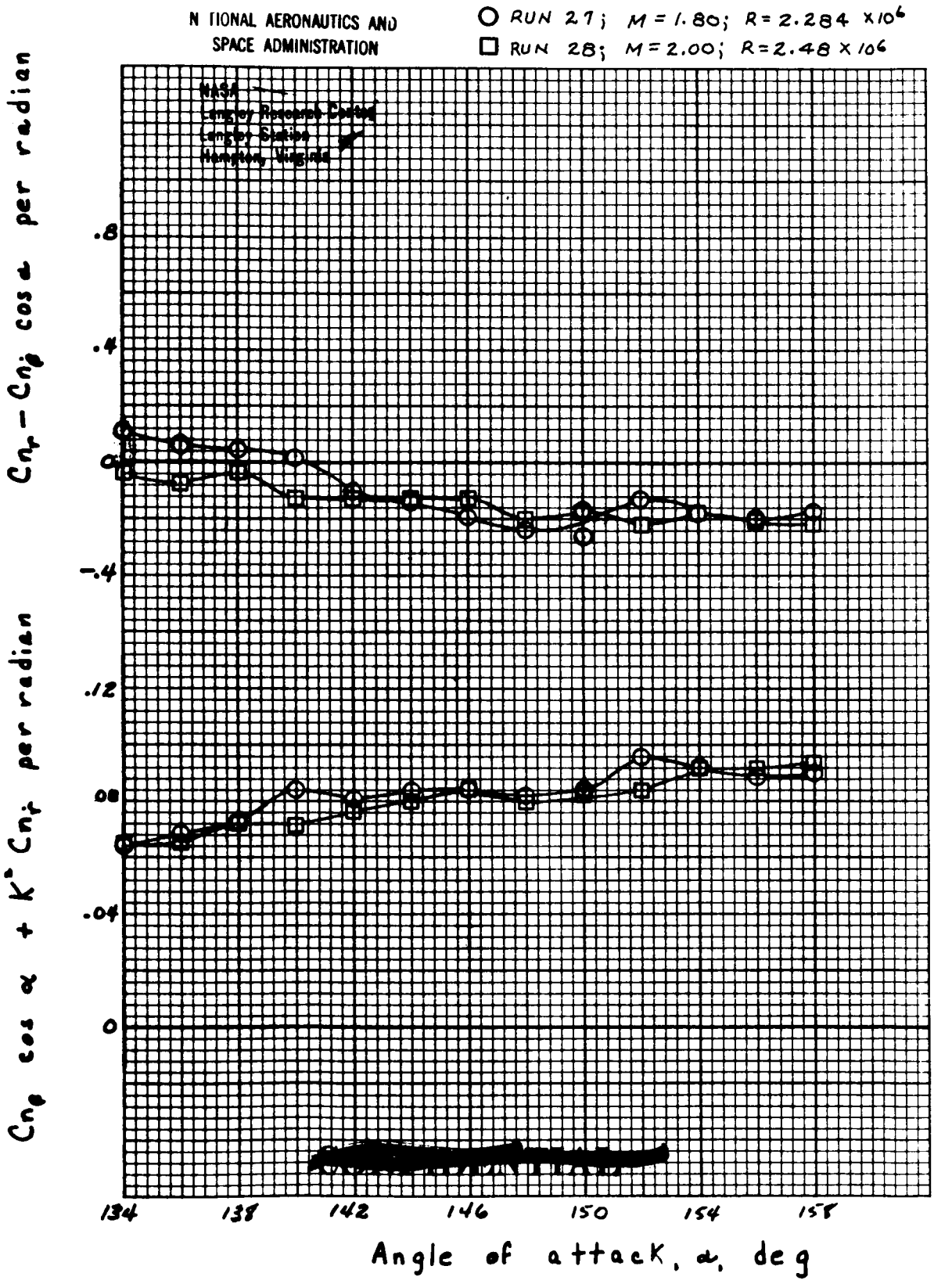


FIGURE 10: VARIATION OF THE DAMPING-IN-YAW PARAMETER AND THE OSCILLATORY DIRECTIONAL STABILITY PARAMETER WITH ANGLE OF ATTACK.
ENTRY CONFIGURATION (NO SPACER)
M = 1.80 & 2.00

CONFIDENTIAL

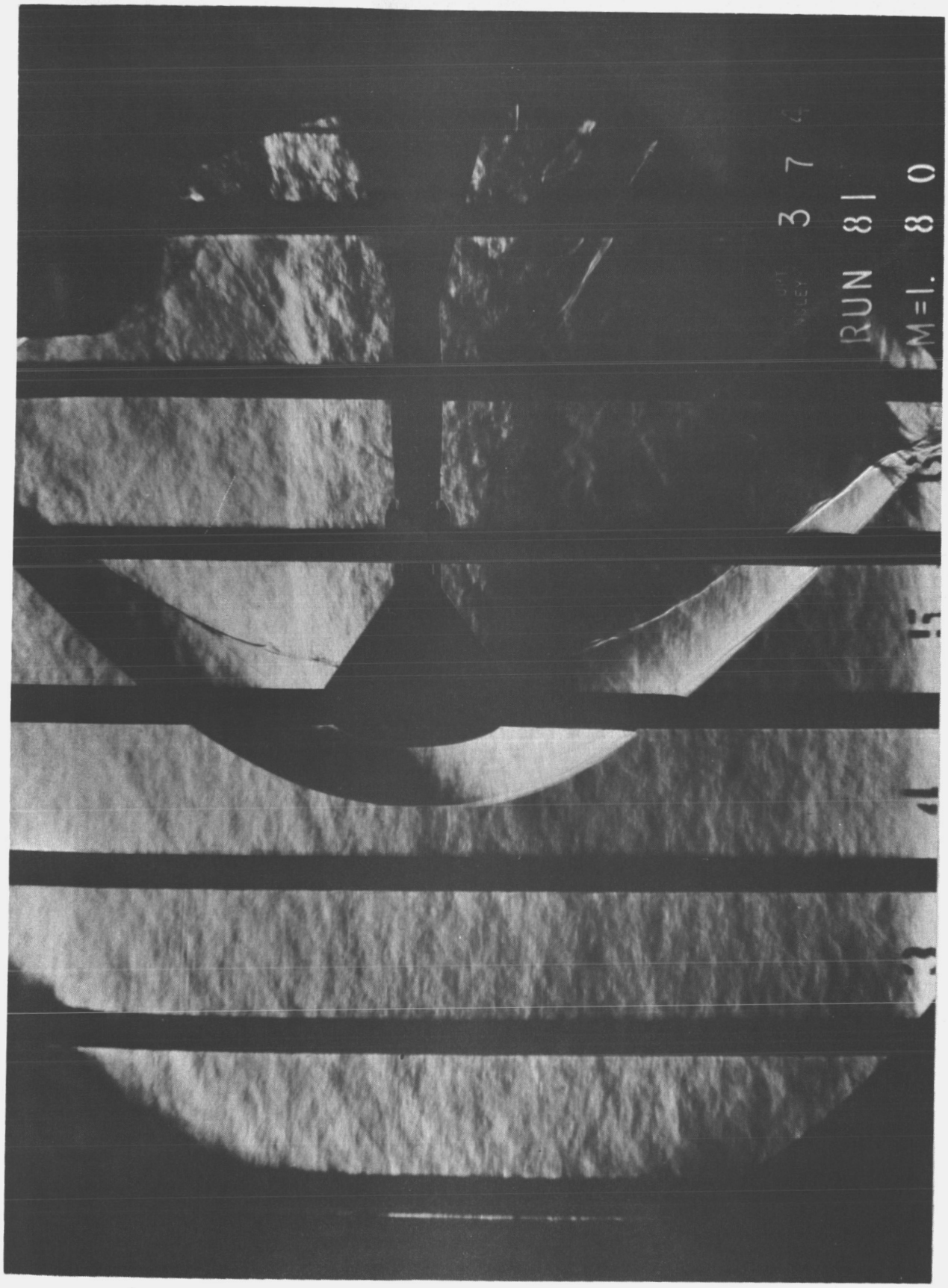


Fig. 11a Schlieren Photo at M = 1.80, Command Module (C) - Entry Attitude, α= 180°

CONFIDENTIAL

CONFIDENTIAL

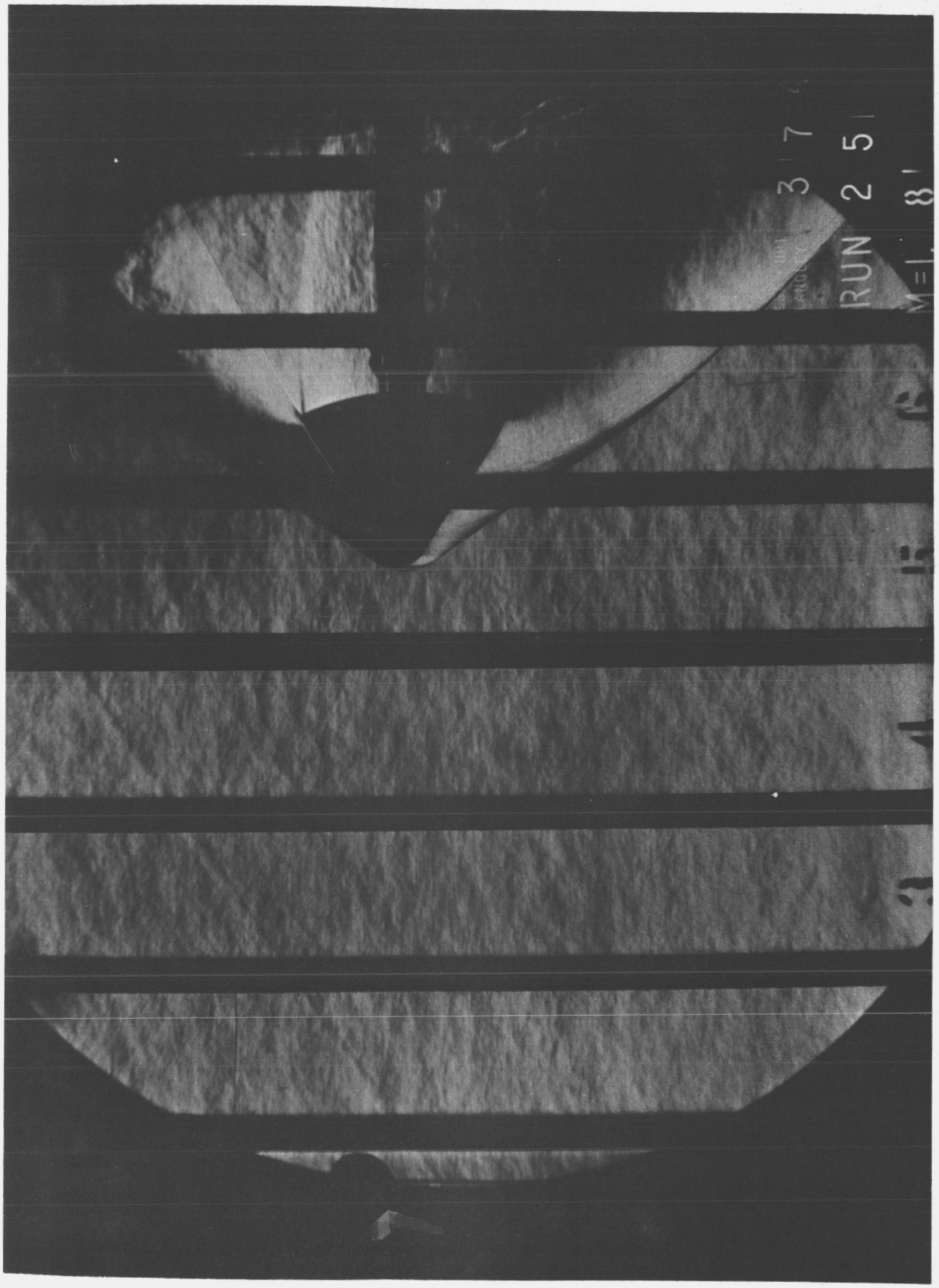


Fig. 11 b Schlieren Photo at M = 1.80, Command Module (C_2) Exit Attitude, α=0°

CONFIDENTIAL

CONFIDENTIAL

Fig. 11c Schlieren Photo at M = 1.80, Launch Escape Config. ($E_{35}T_{15}$ C_2), α=0°

CONFIDENTIAL

CONFIDENTIAL

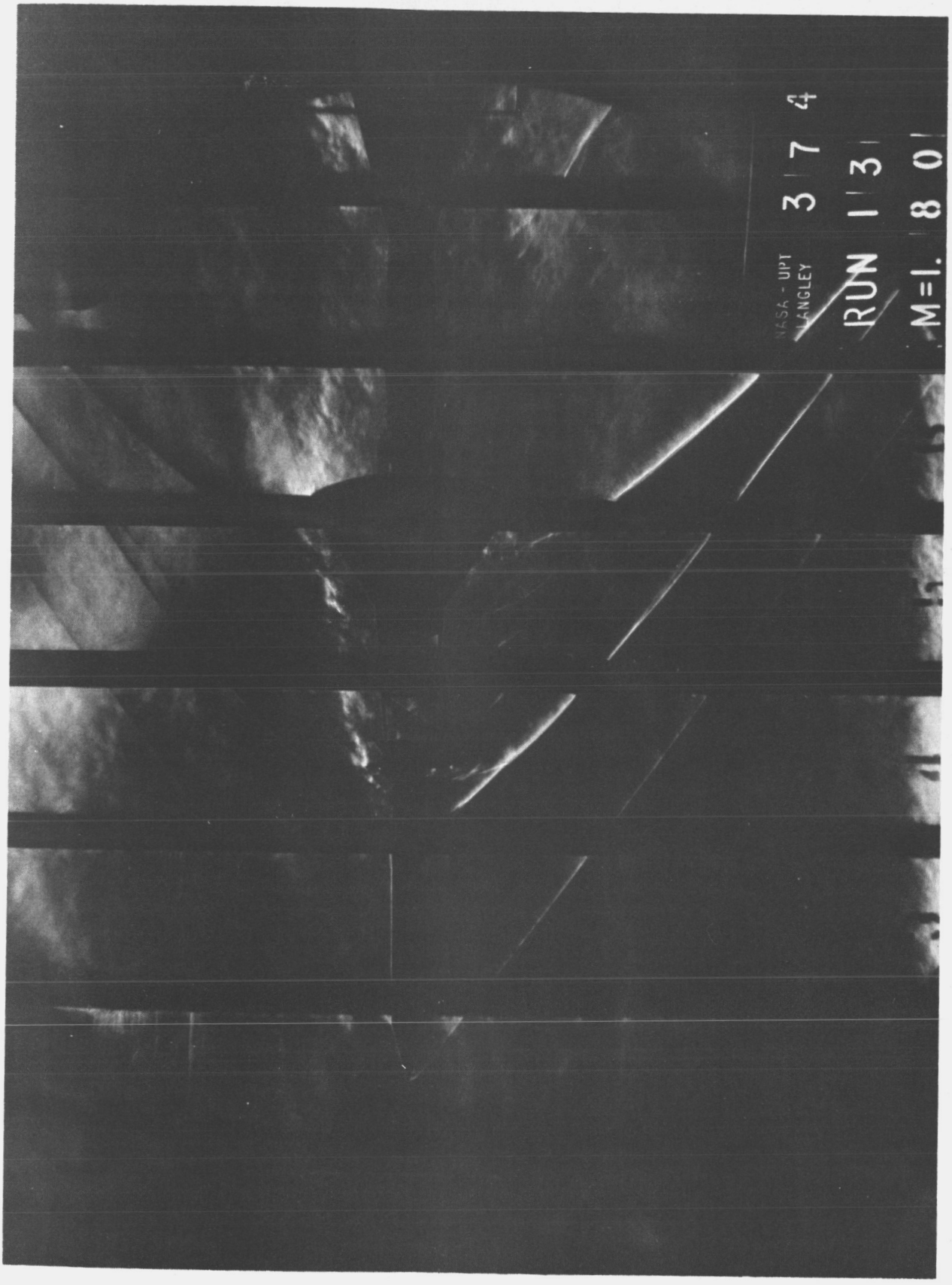


Fig. 11d Schlieren Photo at M = 1.80, Launch Escape Config. (E_{40} T_{15} C_2), α=0°

CONFIDENTIAL